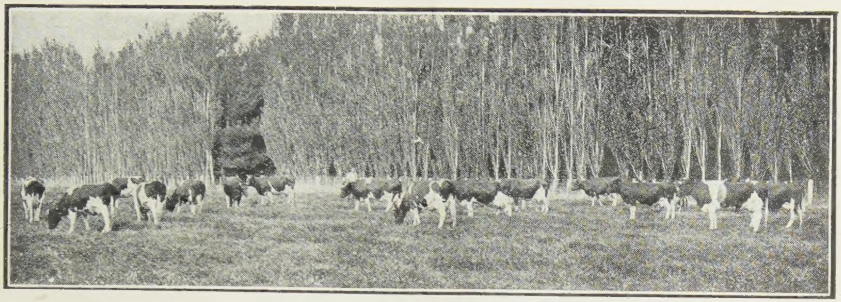

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THE GRASSLANDS OF NEW ZEALAND.

(Continued.)

PRELIMINARY ECOLOGICAL CLASSIFICATION OF SPECIES.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

FOR uncounted ages Nature has been modelling the plant population of the earth, and the effort has been to clothe every feature of the earth's surface with some class of vegetation. In our own wonderful forests we see Nature's handiwork: how she works up from one type of vegetation to another, retaining the hardier type of plants where conditions remain hard, and building gradually towards a greater and more luxuriant vegetation as conditions for plant-life are made easier through modification of the environment. Just how these modifications in the environment occur, and just how Nature works in the modelling of the plant cover to suit altered conditions, does not concern us here. It is plain for all to see that for every soil and climatic type in natural New Zealand there is a different plant, or set of plants, dominant in the vegetation. In our pastures also, although these are made up mainly of species of plants from floras other than our own, yet we must realize that each plant is the product of ages of natural selection and modification, each built to suit certain aspects of soil and sets of environmental conditions.

The endeavour of this article is to classify, under as many heads as possible, the commoner pasture-plants, so that we may the more

readily see just which soil type and which set of environmental conditions suit the growth and proper development of each species. There are seven main factors that govern dominance or subjection of any one species, or set of species, in our pastures: (1) Soil-fertility; (2) soil-moisture content; (3) intensity of light and shade; (4) climatic conditions; (5) growth-form of the plant; (6) seasonal growth of the plant; (7) palatability of the plant. A consideration of each of these factors will show the extent to which each influences the change or stability that occurs in the pastures.

THE SOIL-FERTILITY FACTOR.

In a previous article in this *Journal*—May, 1924, pp. 294–300—it was pointed out by the writer that each grassland species demands the maintenance of a certain standard of soil-fertility in order that that species may thrive. Some species demand a high standard of fertility; others thrive well under a very low standard of fertility. In Table 1 of the present article an effort has been made to show how the fertility factor governs dominance or subjection among grasses and clovers that constitute our grasslands. An inspection of the table will show the important part the fertility factor plays in deciding just which species or set of species will form the dominant herbage of the permanent pasture. If, for example, all the species enumerated in the table were sown on fertile, damp soil, it would be found in the course of time, provided fertility were maintained, that the grasses at the head of the list would dominate all the rest. Again, if the whole of the species were sown on soils not quite so fertile nor so damp we should find that the species a little lower down in the list would become dominant, and just so long as the fertility were maintained at a constant high level the composition of the pasture would remain constant.

Now, supposing the fertility of the country was up to the perennial rye-grass standard, and there set in a gradual reduction of fertility, it would be found that the rye-grass would soon begin to dwindle, and its place as the dominant of the pasture would be usurped by a plant or plants lower down in the list—possibly by cocksfoot. Cocksfoot would thrive and persist as the dominant just so long as the fertility present in the soil was sufficient to keep it growing strong and vigorous. A further reduction in fertility would see this species in its turn dwindle, and there would be a corresponding opening-up of the turf. A grass such as brown-top would now come to the fore and become the dominant. As the fertility became more and more reduced, however, brown-top in its turn would become stunted, presenting then a dry, matted, low-production pasture. From this point the running would most probably be taken up by Danthonia pilosa, associated with the lower-production clovers. In North Auckland Danthonia pilosa, on the poorer knolls, gives place to Danthonia semiannularis, or it might be quite overrun with the useless hair-grass. These latter plants dominant in a pasture would possibly represent the lowest state of soil-fertility it were possible to get in our artificial grasslands.

This illustration just serves as an example of what may happen as fertility falls. If the low-fertility-demanding grasses are not present on the area or are prevented from migrating on to it, low-fertility-demanding weeds will then take up the running in their stead. Weeds

Table 1.—Showing the Commoner Species of Grasses and Clovers arranged in Descending Order according to Soil-fertility Requirement (the topmost species demanding the highest state of fertility, the bottom ones the lowest state).

(The plus sign indicates dominance; the minus sign indicates subjection.)

Name of Pasture-plant.	Extremely High Fertility.	High Fertility.	Moderately High Fertility.	Average Fertility.	Moderately Low Fertility.	Low Fertility.	Very Low Fertility.
Meadow-foxtail	+	+	+	−	−	−	−
Poa trivialis	+	+	+	−	−	−	−
Prairie-grass	+	+	+	−	−	−	−
Tall fescue	+	+	+	−	−	−	−
Timothy	+	+	+	+	−	−	−
Alsike	+	+	+	+	−	−	−
Red clover	+	+	+	+	−	−	−
Italian rye-grass	+	+	+	+	−	−	−
Meadow-fescue	−	+	+	+	−	−	−
Perennial rye-grass	−	+	+	+	−	−	−
White clover	−	+	+	+	+	−	−
Paspalum	−	+	+	+	+	+	−
Yorkshire fog	−	+	+	+	+	+	−
Cocksfoot	−	−	+	+	+	−	−
Crested dogstail	−	−	+	+	+	−	−
Poa pratensis	−	−	+	+	+	−	−
English trefoil	−	−	+	+	+	−	−
Strawberry-clover	−	−	+	+	+	−	−
Red-top	−	−	+	+	+	−	−
Tall oat-grass	−	−	+	+	+	−	−
Poa nemoralis	−	−	+	+	+	+	−
Brown-top	−	−	−	+	+	+	−
Lotus major	−	−	−	+	+	+	−
Subterranean clover	−	−	−	+	+	+	−
Yarrow	−	−	−	+	+	+	−
Sweet vernal	−	−	−	+	+	+	−
New Zealand rice-grass	−	−	−	−	+	+	+
Danthonia pilosa	−	−	−	−	+	+	+
Ratstail	−	−	−	−	+	+	+
Chewings fescue	−	−	−	−	+	+	+
Lotus hispidus	−	−	−	−	+	+	+
Suckling-clover	−	−	−	−	+	+	+
Clustered clover	−	−	−	−	+	+	+
Haresfoot trefoil	−	−	−	−	−	+	+
Danthonia semiannularis	−	−	−	−	−	+	+
Grimmer-grass	−	−	−	−	−	+	+
Bay-grass	−	−	−	−	−	+	+
Hair-grass	−	−	−	−	−	+	+

or low-fertility grasses and clovers coming into a pasture indicate almost certainly that the fertility of that soil is becoming exhausted. (See also page 368 of this article regarding effect of close and continuous grazing.)

It will be seen from the foregoing that a reduction in fertility brings about a change in dominance of the different species or sets of species. But what happens to those species when their place as dominants is usurped by another? I think it is fairly safe to say that if we examined the turf, even when the fertility has fallen as low as it is possible to fall, we would still find some remnants or vestiges of the former dominants. Now, just as the composition of the pasture changes during a reduction of fertility, so does the composition change as the fertility of the soil becomes increased. Increasing the fertility of a danthonia sward, for example, does not lead to an enormous growth of danthonia, but rather to a change in the composition of the pasture. Again, as soon as the soil-fertility of brown-top pastures is improved we see white clover increase. A little later crested dogstail, cocksfoot, and even rye-grass will manifest themselves, and will vie successfully for place along with the brown-top. Each step of soil-fertility increase, therefore, will be marked by the re-entrance of additional species higher in the production scale—that is, provided these species have been included in the original sowing. In other words, as soon as fertility is increased up to the standard of the better grasses and clovers these gradually reappear, and so long as the maintenance of fertility goes on these will become strong and vigorous again and will gradually replace the poorer elements of the pasture.

One sees this happening in New Zealand in almost every pasture that is being liberally and systematically top-dressed. The better grasses and clovers will come back, and will dominate the pasture just so long as they are liberally fed. It has been the custom for farmers to abuse the inferior grasses and clovers that come into their pastures, and which, according to them, "oust the better grasses." The plain truth, I think, is this: that the better grasses and clovers have been starved through lack of plant-food, and so weakened thereby that the entry of inferior grasses and low-fertility-demanding weeds was made possible. If the farmer will only feed his better grasses and clovers sufficiently with artificial manures, &c., there is virtually no danger of their ever being replaced by inferior grasses and weeds.

Yet one must not lose sight of the economics of the situation. On soils naturally fairly fertile, and where the moisture is plentiful, I should say it would be possible and economically sound to maintain fertility well up to the rye-grass standard. But on naturally poor soils, should the rye-grass sward there be the objective, or must one be satisfied with something lower in production but which will thrive well under poorer and harder conditions? On poor soils, then, on difficult, rough country, is it sound to aim at a high-production pasture costly to obtain and to maintain, or should we aim at a lower-production pasture that is easier and surer to get and cheaper to maintain? These are questions calling aloud for economic investigation, and until such work is carried out we do not know whether on poorer, difficult country it pays to build up fertility so that the higher-production pastures may result. One thing seems certain, that until such time as artificial manures become cheaper and facilities for applying are improved the

greater portion of the difficult hill country must be satisfied with a sward of low-fertility-demanding grasses and clovers. Even on these areas, however, experiment may prove the possibility of improving in one way or another the fertility of the soil, and then will be seen, just as in the case of the ploughable areas and easier hill country, a return of the higher-producing grasses and clovers.

THE FACTOR OF SOIL-MOISTURE CONTENT.

The second great factor that helps to decide dominance or otherwise in our pastures is the soil-moisture content. When the arrangement of the species is studied under this head (Table 2) it becomes obvious that the arrangement coincides very closely with that in Table 1. A soil is fertile only so long as the plant-food contained therein is in solution. Therefore, as soon as a soil becomes dry it becomes barren, incapable of supporting plant-life. Most of our grasses and clovers are very shallow feeders, and dry weather for any length of time means a reduction in available fertility at the surface. Thus it is found that in a dry district hardy, low-fertility-demanding grasses are the rule. In districts of very low rainfall, such as Central Otago, are soils virtually barren until the all-important moisture content is improved by irrigation. Once the water is got on to those soils heavy crops of high quality result. In Hawke's Bay, again, in a dry season available fertility is low and the predominating vegetation of the hill pastures appears to be danthonia; but in the early spring and right throughout a wet season a decided increase in the rye-grass and white-clover content can be noted. The soil-moisture content of a pasture therefore largely regulates the composition of the pasture, for upon this factor depends the amount of plant-food that is rendered available.

In a wet climate where there is sufficient moisture in the soil to render available plant-food contained therein, just so long as the supply of plant-food lasts there will persist the high-production grasses and clovers. But it must be borne in mind that while a soil is moist there is a continual drain on the supply of plant-food contained in it, and thus soils in a wet district are more likely to become exhausted of their fertility quicker than those where periodical dry spells arrest the outgo of plant-food. Therefore top-dressing with artificial manures, or the adoption of some method to maintain fertility, is more necessary in wet than in dry districts. Generally speaking, this has been proved in practice, artificial manures almost invariably giving better results in a wet district than in a dry district. The loss of fertility in a wet district by leaching also must be made good.

In agricultural development the regulation of the moisture factor by drainage has received a great deal of attention, and rightly so, in all classes of agricultural land where cultivation and cropping are being carried out. So far as our grasslands are concerned, while drainage often is an essential, yet I am of the opinion that there is such a thing as overdrainage. Reference to Table 2 will show that high-yielding grasses like meadow-foxtail, Poa trivialis, timothy, &c., require a high water content in the soil, and if this is removed by drainage it simply means the farmer must adopt lower-yielding grasses and clovers that can persist under the drier conditions. Again, in the case of soils that are impossible to drain, it is useless sowing down

Table 2.—Showing the Commoner Species of Grasses and Clovers arranged in Descending Order according to Requirement in Soil-moisture Content.

(The plus sign indicates tolerance of wet or dry conditions; the minus sign indicates intolerance of wet or dry conditions.)

Name of Pasture-plant.	Swamp and Flood Area.	Very Wet or Water-logged.	Wet Soils.	Average Degree of Soil-moisture Content.	Fairly Dry.	Extremely Dry.
Floating sweet-grass ..	+	+	−	−	−	−
Poa aquatica	+	+	−	−	−	−
Creeping-bent	−	+	+	−	−	−
Paspalum	−	+	+	+	+	−
Lotus major	−	+	+	+	+	−
Yorkshire fog	−	+	+	+	+	−
Tall fescue	−	+	+	+	−	−
Meadow-foxtail ..	−	+	+	+	−	−
Poa trivialis	−	+	+	+	−	−
Timothy	−	+	+	+	−	−
Meadow-fescue ..	−	+	+	+	−	−
Alsike	−	−	+	+	−	−
Prairie-grass	−	−	+	+	−	−
Red-top	−	−	+	+	−	−
Brown-top	−	−	+	+	+	−
Sweet vernal	−	−	+	+	+	+
Italian rye-grass ..	−	−	+	+	+	−
Perennial rye-grass ..	−	−	+	+	+	−
White clover	−	−	+	+	+	−
Crested dogstail ..	−	−	+	+	+	−
Cocksfoot	−	−	+	+	+	−
Poa pratensis	−	−	+	+	+	−
Red clover	−	−	+	+	+	−
Strawberry-clover ..	−	−	+	+	+	−
Subterranean clover ..	−	−	+	+	+	−
English trefoil ..	−	−	+	+	+	−
Poa nemoralis	−	−	+	+	+	−
Tall oat-grass	−	−	+	+	+	−
Lotus hispidus ..	−	−	+	+	+	+
Chewings fescue ..	−	−	+	+	+	+
Yarrow	−	−	−	+	+	+
New Zealand rice-grass ..	−	−	−	+	+	+
Danthonia pilosa ..	−	−	−	+	+	+
Ratstail	−	−	−	+	+	+
Bay-grass	−	−	−	+	+	+
Suckling-clover ..	−	−	−	+	+	+
Haresfoot trefoil ..	−	−	−	−	+	+
Grimmer-grass ..	−	−	−	−	+	+
Danthonia semiannularis	−	−	−	−	+	+
Hair-grass	−	−	−	−	+	+

those areas with species that will not tolerate wet conditions. Perennial rye-grass, for example, will not stand "wet feet" in the winter, and where the effort is to keep this grass as the dominant permanent element of the pasture the surface water must be removed by drainage. An alternative to drainage, however, would be to use wet-tolerating grasses such as meadow-foxtail, Poa trivialis, timothy, or paspalum. On certain parts of the Hauraki Plains, and on other low-lying areas in New Zealand where the winter conditions are often too wet for perennial rye-grass to thrive, the use of this grass alone leads to an opening-up of the turf in the winter and to an incoming of buttercup, pennyroyal, rushes, &c. If, on the other hand, wet-tolerating grasses such as those mentioned were used there would not be such opening-up of the pasture turf during the wet period, with the result that none of the weeds mentioned above would gain entrance into the pasture. To keep meadow-foxtail and its associates thriving well, however, the soil-fertility must be maintained at a high standard. Paspalum will thrive on soils very much lower in fertility.

From a comparative study of Tables 1 and 2 it will be seen that so long as there is a fairly high degree of moisture in the soil the farmer can do almost anything by the use of artificial manures, as far as regulating the composition of his pastures is concerned; but just so soon as a soil becomes dry he is impotent to effect that improvement by artificial manures alone. In dry districts, therefore, methods of fertility increase, and pasture-improvement must be along lines of moisture-conservation rather than in the application of artificial manures alone. The moisture in the soil is of no value if there is no plant-food there to be rendered soluble, nor is plant-food in the soil of any value if the soil-moisture factor is absent.

THE FACTOR OF LIGHT AND SHADE.

In any natural vegetation, in the establishment and regeneration of forests, and in the succession that takes place within those forests perhaps the most important factor of all governing change is the relative intensities of light and shade. In our grasslands the same principle is at work, and is one of the governing factors in pasture establishment and succession. In Table 3 an attempt has been made to group the commoner pasture-plants according to light and shade requirement of the different species.

It has been already pointed out that pasture-plants with their crown at or above ground-level are liable to extinction by close and continuous grazing. This is particularly true of shade-demanding grasses. Glancing at the table it will be readily noticed that the light-loving grasses are mainly those of hard situations, and are of low production. The better grasses of many pastures owe their extinction as producers largely to an excess of light getting at the crown under the bad practice of close and continuous grazing. Spelling for a whole season, or intermittent spelling and grazing, allows foliage-development which creates shade for the crown. Under such treatment shade-demanders again become strong in a pasture, and light-loving plants gradually weaken. The persistence of cocksfoot on Akaroa hill country can be very largely attributed to the fact that each year these areas

Table 3.—Showing the Commoner Species of Grasses and Clovers arranged according to Tolerance or Intolerance of Light and Shade.

(The plus sign indicates tolerance of light or shade; the minus sign indicates intolerance of light or shade.)

Name of Pasture-plant.	Fairly Dense Shade.	Shady.	Somewhat Shady.	Light-intensity of Average Pasture Conditions.	Fairly Open and Sunny Aspect.	Extremely Sunny and Open Aspect.
New Zealand rice-grass	+	+	+	+	+	+
Lotus major	+	+	+	+	–	–
Prairie-grass	+	+	+	+	–	–
Cocksfoot	+	+	+	+	–	–
Poa trivialis	+	+	+	+	–	–
Yorkshire fog	+	+	+	+	–	–
Tall fescue	+	+	+	+	–	–
Meadow-foxtail	+	+	+	+	–	–
Timothy	+	+	+	+	–	–
Poa pratensis	+	+	+	+	–	–
Brown-top	+	+	+	+	+	–
Paspalum	+	+	+	+	+	–
Meadow-fescue	–	+	+	+	–	–
Tall oat-grass	–	+	+	+	–	–
Poa nemoralis	–	+	+	+	–	–
Sweet vernal	–	+	+	+	+	+
Red-top	–	+	+	+	–	–
Italian rye-grass	–	+	+	+	–	–
Perennial rye-grass	–	–	+	+	–	–
Red clover	–	–	+	+	–	–
Alsike	–	–	+	+	–	–
Subterranean-clover	–	–	+	+	+	–
Crested dogstail	–	–	+	+	+	–
English trefoil	–	–	+	+	+	–
White clover	–	–	+	+	–	–
Strawberry-clover	–	–	+	+	+	–
Lotus hispidus	–	–	–	+	+	+
Yarrow	–	–	–	+	+	+
Ratstail	–	–	–	+	+	+
Chewings fescue	–	–	–	+	+	+
Danthonia pilosa	–	–	–	+	+	+
Suckling-clover	–	–	–	+	+	+
Bay-grass	–	–	–	–	+	+
Danthonia semiannularis	–	–	–	–	+	+
Grimmer-grass	–	–	–	–	+	+
Haresfoot trefoil	–	–	–	–	+	+
Hair-grass	–	–	–	–	+	+

are spelled for the production of seed, and that consequently the shade factor necessary for the prosperity of this grass is provided. How often is it noticeable in a hayed field that the bottom has gone out of

the pasture—a reaction due almost entirely to the fact that bottom grasses are light-demanders and top grasses are shade-endurers. The shutting-up of the pasture for hay promotes the growth of shade-demanders, and these by their growth create shade detrimental to the light-demanding bottom grasses; consequently there is a reduction of bottom grasses in the pasture and an increase of the top grasses. In districts where cocksfoot is inclined to get away, this grass may often form an almost pure association by its killing out the bottom grasses through the dense shade it creates.

In the establishment of pasture-plants the light factor plays a most important part. Slowly-establishing plants are often killed out in the initial stages of the pasture owing to the fact that light is excluded from them by the more vigorous early-establishers in the pasture. Where the effort is to get light-demanders established as quickly as possible, a regulation of the mixture accordingly should be considered.

A very important aspect of management to exclude weeds gaining entrance into a pasture from seeds—either blown into or lying dormant in the soil—is to exclude as much light at the soil-surface as possible. Very few seedlings will establish in dense shade. Here, again, is where close and continuous grazing of the pasture so facilitates the entrance of weeds. It can be said almost with certainty that the greater number of our pasture weeds come in as a result of keeping the turf too bared to the ground. A few of these may be cited: Rushes, pennyroyal, Scotch thistle, catsear, rib-grass, field-daisy, selfheal, cudweed, piripiri, manuka, &c.

Perhaps it is on the hill country that the light and shade factor acts most potently. In the first place, the worst forms of secondary growth establish only where there is light right to the soil-surface. The removal of the forest by the burn brings the light factor to bear, and unless there has been a very severe fire myriads of secondary-growth plants spring into being—wineberry, fuchsia, hard-fern, water-fern, and bracken-fern being among the most common. If a close sward of grass could be got immediately over the whole soil-surface it is probable that none of these species would establish, but, unfortunately, this is not possible. Irrespective of the care in sowing or of the quantity of seed applied, there are bound to be some small areas where grass-seed has failed to establish. The principle holds, however, that admission of light to the soil-surface is necessary for the establishment of most of the secondary growth of the hill country—and, in fact, for the establishment of most plants from seeds. The problem of secondary-growth control of the hill country, once such growth has become well established, lies either in the establishment among that growth of shade-enduring grasses and clovers, or in its entire removal, so that the light-loving persistent danthonia type of plant may thrive. This has been the lesson taught by the extensive experience of some millions of acres of hill country that have been successfully grassed.

The use of fire, of cattle, and of the slashhook is primarily to the end of allowing light to reach the soil-surface so that grasses striving there may be strengthened, and so that any seeds of the hardier grasses that are there, or that migrate, or are sown there, may have the

necessary light stimulus to spring into being. Where fire can be utilized successfully for the destruction of secondary growth I think there is no doubt that this is the most economical system. Repeated burning hinders the development of most forms of secondary growth, and vastly encourages the spread and development of danthonia and of any other grasses that may be persisting in the shade of the secondary growth. To my mind the solution as regards the great bulk of difficult hill country lies in the establishment on that country of shade-enduring grasses and clovers that will entice stock to work among the secondary growth, and that will carry a fire at any period of the year when the secondary growth is sufficiently dry for that purpose. The establishment of these grasses and clovers on the fern or scrub-infested areas, and repeated burning at every available opportunity, seems the most economical way of bringing the deteriorated country back.

What is wanted, then, are grasses and clovers that will endure shade, that will carry a fire, that will recover rapidly after burning, and are sufficiently palatable to keep stock working on the area. Stock, particularly cattle, go into the secondary growth and break it down by their treading, thus admitting the light on to the ground where any grass or clover plants might be struggling. The objective of cattle is thus much the same as that of burning—namely, the removal of shade so that the grasses and clovers beneath may get the all-essential strength-giving light. It must be borne in mind that we have no grasses and clovers at present that will endure dense shade, and it is only by keeping the secondary growth somewhat down and comparatively open that the shade-intensity of the secondary growth may be reduced to the point at which our best shade-endurers will thrive among it. The light-loving plants, particularly danthonia, will come in almost certainly, even on their own account, once the secondary growth is so controlled that it creates practically no more shade.

THE TEMPERATURE FACTOR.

With the exception of a few species, it may be said that New Zealand is sufficiently temperate for all the commoner species of pasture-plants enumerated in the tables to thrive here. In the colder districts, certainly, growth is slower to come away in the spring, and the seasonal growth is of shorter duration. The temperature factor operates in our grasslands, in so far as the regulation of change among the component species is concerned, mainly to the point of deciding how far south paspalum can be profitably employed in the pasture. The spread of this grass to prime place in New Zealand grasslands is restricted almost entirely by temperature.

THE FACTOR OF GROWTH-FORM.

Growth-form in plants is the outcome of the modelling processes of nature throughout the eons of time. In Table 4 an effort has been made to arrange the pasture species according to their growth-form. It is difficult to summarize growth-form in this way, owing to the great adaptability and plasticity of each species, yet the tabulation gives one some idea of the normal growth-form each pasture species possesses.

Table 4.—Showing the Commoner Species of Grasses and Clovers arranged according to Growth-form.

(The plus sign indicates the presence of a specific character; the minus sign indicates the absence of that character.)

Name of Pasture-plant.	Crown at or above Ground level.	Crown below Ground-level.	Plant Tufted.	Plant Mat-forming.	With Short Underground Tillers.	With Underground Creeping-stem.	Stolon iferous.
Floating sweet-grass	-			+			-
Poa trivialis				+	-		+
Creeping-bent	-			+			-
White clover	-			+			
Strawberry-clover				+			+
Prairie-grass							
Timothy	-		-				-
Italian rye-grass				-		-	
Cocksfoot	-						-
Crested dogstail			-				
Alsike	-		-				
Red clover	-			-	-		
English trefoil	-		-			-	-
Sweet vernal	-		-	-		-	-
Yorkshire fog	-	-	-	+			+
Lotus hispidus	-		*	-	-		
Subterranean clover	-	-	*			-	-
Suckling-clover	+		*				
Clustered clover	+		*	-		-	-
Haresfoot trefoil	-	-	*	-	-		
Hair-grass	-		-	-			-
Tall fescue	-	-	-		-	-	-
Tall oat-grass	+		-		-		
Ratstail			-		-		-
Bay-grass		+	-	-	+		-
Meadow-foxtail		-	-	-	+		-
Poa nemoralis	-	-	-	-	+	-	
Paspalum		+	-	-	+		
Danthonia pilosa	-	+		+	+		
Danthonia semiannularis	-	+		-	+		
Chewings fescue		+		+	+	-	-
Grimmer-grass	-	+		+	-	-	
New Zealand rice-grass		+	-	+	+	+	-
Brown-top		+			+	+	-
Lotus major	-	+	-	+	-	+	+
Yarrow	-	+	-	+		+	
Red-top	-	+		+	-	+	-
Poa pratensis	-	+	-	+	-	+	-
Poa aquatica	-	+	-	+	-	+	-

* Annual plants, erect or more or less trailing.

Growth-form governs persistence or otherwise to a certain extent. Plants with their crown above ground are more liable to be eaten out by stock and are more susceptible to climatic changes, particularly in closely grazed pastures. With few exceptions pasture-plants that have their crown above ground disappear very rapidly from any pasture that is closely and continuously grazed. It has been pointed out before by the writer ("Grasslands of New Zealand" bulletin, p. 12) that the root-system of most grasses is not a permanent accessory to the plant. For each growing season a new root-system is developed, and in the case of grasses that have their crown above ground or at the surface such system has its origin from a node of the creeping-stem of the grass, or from the base of the crown at or immediately below the soil-surface. Drying winds and intense light at the soil-surface hinder the development of new roots, and consequently the growth of the plant is retarded. Close and continuous grazing, therefore, must be regarded as an undesirable practice where it is desired to retain pasture species that have their crown at or above ground-level. With those species that have their crown well below ground and which spread by means of long underground stems or by short underground tillers, close grazing, with its attendant desiccating conditions at the surface, does not affect the system of the plant in the same way. Also, when the root-system is deeper in the soil periodical spells of dry weather have little effect in promoting change in the composition of such pastures.

On hill country and on other difficult soils, such as sand country, peat swamps, &c., where it is extremely difficult, irrespective of what quantity of seed is sown, to get anything like a complete sward right from the offset, the growth-form of the plants sown is of much importance. Tussock-forming or tufted plants, unless of a free-seeding nature, are incapable of much lateral spread, and consequently those places where seed-establishment is impossible, owing to the loose spongy nature of the soil or to its hard and dry surface, either remain open bare patches or become invaded by fern, piripiri, manuka, catsear, or other weeds. In the case of those plants with underground stems or with underground tillers, bare and difficult places in the area sown may ultimately become covered by such plants, which have the means whereby lateral spread is possible. On steep hill country also, where stock readily cut the turf about by their treading, and where soil-movement is rapid once the surface is bared of vegetation, binding grasses are essential. Most of the higher-production grasses that one would like to retain on hill country are of the tufted form, and the binding of these by other pasture-plants to render their displacement more difficult is very worthy of consideration. Again, in the early primary-forest burn, where fertility is high, the tufted-nature plants may grow to a great size and completely cover the ground surface. Then, as soon as depletion of fertility begins, a corresponding shrinkage in size of the tufted plants takes place. Bare spaces appear in the pasture, and here, again, is needed the underground tiller, or the underground creeping-stem, or the overground creeping stoloniferous plant, to fill up these gaps in the turf as shrinkage in size of the tufted plants takes place.

In the sowing-down of arable land to pasture, again, growth-form should be considered, particularly so in districts where pastures are

short-lived and where much cropping is done. Most of the grasses with long underground stems flourish to perfection only while the soil remains loose. Under cultivated conditions, therefore, such plants become very bad weeds. Mention may be made of such grasses as twitch, Poa pratensis, red-top, creeping-fog, yarrow, and brown-top, the eradication of which entails much labour and expense throughout the arable lands of New Zealand that are infested by these plants.

In certain districts advantage is taken of growth-form to rejuvenate certain classes of pastures, either for certain special seed-production purposes or for straight-out grazing. Underground creeping-stem-system plants, as has been already mentioned, thrive best under loose conditions. When the ground becomes consolidated the growth of such species becomes sparse, and it is not until the pasture is broken up again that renewed vigorous growth takes place. The excellent Chewings fescue seed crops produced in Southland are secured on renovated areas simply by ploughing up the old stunted pastures of that grass in narrow furrows. In the North the same practice is adopted for the rejuvenation of sod-bound paspalum pastures, and recently the practice has been very successfully adopted in North Auckland for the renovation of brown-top pastures for seed-production. When this practice is analysed two important factors for plant growth are brought to bear: (1) By a loosening of the soil, scope is given the underground stems to extend; and (2) of the turf ploughed under, that herbage at the lower side of the furrow soon rots and becomes plant-food for those few plants that survive along the uppermost edge of the furrow. Thus the practice is essentially one leading, as far as the surviving plants are concerned, to an increase of fertility.

Stoloniferous plants in general, unless these are capable of sending down strong roots from the creeping-stem, feel the pinch of dry conditions very readily. Poa trivialis, white clover, and strawberry-clover, for example, cease to flourish when conditions become at all dry at the surface. Certain of the hardier forms of stoloniferous plants, however, like kikuyu, buffalo-grass, and Indian doob, spread fairly readily under rather dry conditions.

A useful adaptation of nature is seen in those plants that tide over a crucial period in their yearly cycle by the free formation of seed. This trait is very evident in the annual type of pasture-plants. One is apt to look upon the annual as a fickle, unstable class of vegetation, whereas, in fact, annuals are most persistent. They are the colonizers and successful occupiers of dry, hard, difficult situations untenable by many of the perennial type of plants. Generally speaking, a large annual population in our pastures indicates either that there is a fairly long crucial period in the yearly cycle of that pasture, or else that there exists in the pasture a more or less open association due either to the absence of perennial plants or to the fact that what perennials are present are not thriving sufficiently well to form a dense sward. In first-class grasslands where the ground is always covered by vigorous perennial plants annuals have very little chance. For the seed of the annual to re-establish in the autumn a somewhat open type of pasture, with light penetrating well on to the ground surface, must rule. An increase in the annual population in our permanent pastures, therefore, must generally be regarded as indicating a

weakening and opening-up of the permanent-pasture sward, due either to uncontrollable climatic conditions ruling or to a depletion of soil-fertility.

THE SEASONAL-GROWTH FACTOR.

Theoretically, the ideal pasture would be that which contained a number of species whose seasonal growth varied so that there would be provided a uniform and continuous growth throughout the whole year. In practice such a pasture is exceedingly difficult to secure. So many factors are at work that, should a grass or a clover become markedly dominant at any one period of the year, the pasture containing that species is more likely to become a pure association of it, rather than remain a mixed sward in association with other plants whose growing season came at a different period of the year. For plants successfully to hold their own under strong competition within a mixed association it is almost essential that their growing-periods should coincide almost exactly with one another, else the dormant species is almost certain to be smothered out. In more or less open pastures on low-fertility soils, however, there is frequently noted a marked apparent dominance by individual species in that pasture at different seasons of the year. Thus in a pasture consisting largely of sweet vernal, Danthonia pilosa, and brown-top, in the early spring one would say that sweet vernal was the dominant herbage of that pasture. Later on, when danthonia was in full flower, the dominance would seem to have changed in its favour ; and again in the summer and autumn, when brown-top comes to flower and when in seed, it certainly would appear that the pasture was mainly brown-top. If a pasture of this nature were carefully analysed during the maximum growth of each species it would indicate whether or not the apparent dominance was so in actual fact.

An outstanding combination of species of different seasonal growth is well exemplified in paspalum and subterranean-clover pastures. Subterranean clover is essentially an early spring and a fair winter growing clover, while paspalum is essentially a late spring and summer growing grass. By combining the two species there is no doubt that the paspalum pastures are greatly improved. Here any smothering tendency that the subterranean clover may have is of no effect on a strong-growing shade-endurer like paspalum. Again, when paspalum is at its maximum growth subterranean clover is tiding over this smother period as a dormant seed.

Very early spring growing plants—as, for example, annual clovers —may at times have a big influence in promoting change in the permanent pasture. They respond very readily to application of artificial manures, and frequently they are associated with light-demanding grasses. A wet spring, particularly so following top-dressing, may promote such growth that the associate grasses, particularly danthonia, may be completely smothered out.

In Table 5 an effort has been made to arrange the pasture species according to their seasonal growth.

Table 5.—Showing the Commoner Species of Grasses and Clovers arranged according to Seasonal Growth.

(The plus sign indicates maximum growth; the circle sign indicates moderate growth; the minus sign indicates little or no growth.)

Name of Pasture-plant.	Early Spring.	Spring.	Summer.	Early Autumn.	Late Autumn.	Mild Winter.	Severe Winter.
Floating sweet-grass ..	+	+	O	O	–	O	–
Poa aquatica	O	+	–	+	O	–	
Meadow-foxtail	+	+	O	–	O	O	O
Poa trivialis	+	+	–	–	O	O	
Prairie-grass	+	+	–	–	O	+	O
Italian rye-grass	+	+	–	O	O	O	–
Yorkshire fog	+	+	–	–	O	+	O
Crested dogstail	+	+	–	O	O	O	–
Poa pratensis	O	+	–	–	O	O	
Sweet vernal	+	+	–	–	O	O	O
Tall oat-grass	O	+	O	–	–	–	–
Danthonia pilosa	+	+	–	–	O	O	O
Danthonia semiannularis ..	+	+	–	–	O	–	–
Subterannean clover.. ..	+	+	–	–	O	O	–
Perennial rye-grass	O	+	–	–	O	O	–
Tall fescue	+	–	O	–	O	O	–
Lotus hispidus	O	+	–	–	–	–	–
Suckling-clover	O	+	–	–	–	–	–
Clustered clover	O	+	–	–	–	–	–
Haresfoot trefoil	O	+	–	–	–	–	–
Hair-grass	+	+	–	–	–	–	–
Timothy	–	+	+	–	O	–	–
Alsike	–	+	+	–	O	–	–
Red clover	–	+	+	O	O	–	–
Meadow-fescue	–	+	O	–	O	–	–
Poa nemoralis	–	+	O	O	–	–	–
White clover	O	+	–	–	O	O	–
Strawberry-clover	–	+	–	–	O	–	–
Cocksfoot	–	+	+	O	O	–	–
English trefoil	–	+	O	–	–	–	–
Red-top	–	+	O	–	O	–	–
Yarrow	–	+	O	–	O	–	–
Lotus major	–	+	+	O	O	–	–
Brown-top	–	+	+	O	O	O	–
Chewings fescue	–	+	–	–	O	O	–
New Zealand rice-grass ..	–	+	O	–	O	–	–
Grimmer-grass	–	+	+	O	–	–	–
Bay-grass	–	O	+	–	–	–	–
Ratstail	–	O	+	O	O	–	–
Paspalum	–	O	+	+	O	–	–

Table 6.—Showing the Commoner Pasture-plants arranged in Descending Order according to Palatability.

(The plus sign indicates a high state of palatability; the circle indicates medium palatability; the minus sign indicates low palatability.)

Name of Pasture-plant.	Young Fresh Herbage.	Somewhat Matured Herbage.	Old and Rank Herbage.	Stunted Ill-natured Herbage.	Herbage matured as Hay.
Timothy	+	+	O	O	−
Meadow-fescue	+	+	O	O	−
Italian rye-grass	+	+	O	O	−
Perennial rye-grass	+	+	O	O	−
Crested dogstail	+	+	O	O	O
Poa pratensis	+	+	O	O	+
Meadow-foxtail	+	+	O	O	−
Poa trivialis	+	+	O	−	−
Floating sweet-grass	+	+	O	O	+
Alsike	+	+	+	O	−
Suckling-clover	+	+	+	O	−
Subterranean clover	+	+	O	O	−
White clover	O	−	−	O	−
Strawberry-clover	O	+	+	O	−
English trefoil	O	+	O	−	−
Red clover	O	−	O	O	−
Prairie-grass	−	+	O	−	+
Cocksfoot	−	+	−	−	+
Paspalum	+	O	−	−	+
Brown-top	+	O	−	−	−
Red-top	+	O	−	−	+
Danthonia pilosa	+	O	−	−	+
Lotus major	O	O	−	−	O
New Zealand rice-grass	O	O	O	−	+
Yorkshire fog	O	−	−	−	O
Tall oat-grass	−	−	−	−	+
Yarrow	O	O	O	−	O
Chewings fescue	O	O	−	−	+
Danthonia semiannularis	+	−	−	−	+
Poa nemoralis	−	−	−	−	+
Lotus hispidus	O	O	−	−	O
Clustered clover	−	−	−	−	+
Ratstail	+	−	−	−	+
Sweet vernal	−	−	−	−	O
Tall fescue	−	−	−	−	O
Poa aquatica	O	O	−	−	−
Hair-grass	O	−	−	−	−
Haresfoot trefoil	−	O	−	−	−
Bay-grass	−	−	−	−	−

THE PALATABILITY FACTOR.

The palatability of the plants that constitute the pasture influences to some extent change of dominance in the association. One has only to think of certain weeds of our grasslands the growth and spread of which can be largely attributed to the fact that their foliage is unpalatable to stock: manuka, hard-fern, rushes, &c., will serve as good examples. Among the commoner grassland species there are none entirely neglected by stock, and the relative palatability of each species depends very largely upon management. Generally speaking, the stronger-growing the grass and the less palatable the herbage the greater the care that must be exercised in the management of those pastures.

From Table 6 it will be seen that most grasses are palatable when the growth is young and fresh, and unpalatable as soon as it gets old and rank. Lack of proper management of a pasture that contains certain less palatable species may result in complete dominance of that pasture by such species. Ratstail, for example, once it gets away rank, is very unpalatable to stock, and unless it is chewed down its free-sending attribute soon enables it to spread and to assume complete charge of the pasture. It appears, therefore, that the species in a pasture most inclined to get away should be the one that would decide just what type of management was necessary for the whole of the species in that pasture. In the case of tall fescue one has a grass not only highly unpalatable in the rank state but very subject to ergot, so that the usual method of keeping rank growth down by cattle is not available without considerable risk. Therefore in fertile, wet soils, tall fescue when once established may soon spread and form an almost pure association of useless herbage.

Generally speaking, grasses growing on dry places in the pasture are the first to get away rank, irrespective of whether that grass is cocksfoot or danthonia. Many an aspersion is cast at a danthonia knoll waving white with rank growth, and the grass is condemned as being unpalatable, whereas the person casting the aspersion is probably standing on the very same grass eaten down so well that it is to him "English grasses."

It is often claimed that when a pasture commences to get away stock wander through picking out individual species that are the most palatable. On this assumption it is explained why the better English grasses are never seen much to advantage when growing within a danthonia or a brown-top sward. From the table it will be seen that I consider the stunted ill-natured herbage of the better English grasses as being less palatable than the young fresh herbage of the second-rate species. Now, it is fairly safe to say that if the growth of a pasture is predominately danthonia or brown-top, then the cocksfoot, &c., within that pasture is never at any time very luxuriant, and hence it is never very palatable. What generally happens when a pasture is getting away is that stock do not wander about over the whole pasture picking out individual species so much as they crop close certain patches within that pasture, and keep these close irrespective almost of what species that particular piece of turf is comprised of. In a paspalum pasture, for example, this is very noticeable. It is the small areas that are kept short, irrespective of species, that

prove the most attractive to stock, and therefore it can be assumed that in this state the grasses are most palatable.

CONCLUSION.

In the accompanying set of tables a preliminary ecological classification of our pasture species has been attempted. Not for a moment is it assumed that the classification as presented is correct in every detail; rather is it set out more or less as an outline guide, to be amplified and remodelled as experimental work of an exact analytical nature is performed. Nevertheless it may be claimed that in the tables themselves and in the text is crystallized much information that should be of value to the farmer in his efforts to learn more concerning his pasture-plants.

CEREAL-SMUTS.

AN ILLUSTRATED KEY TO THE NEW ZEALAND SPECIES.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

NUMEROUS requests have been made for the publication of an illustrated key to the cereal-smuts present in New Zealand, so as to facilitate recognition of each species. It is necessary for the farmer to know each species, for on account of certain differences in their life-histories the smuts are divided into two groups, and each group requires a different control treatment. This article has been prepared accordingly. It has been found necessary to supplement the illustrations with certain descriptive matter, calling attention to the salient features of each species, so as to facilitate diagnosis.

Six species of smuts are present on cereals in New Zealand. These may be most conveniently arranged according to the host (the plant attacked by the smut) as follows :—

On wheat—
Ustilago Tritici Jens.—loose smut.
Tilletia levis Kuehn and *Tilletia Tritici* Wint.—stinking smut.
On barley—
Ustilago Jensenii Rostr.—covered smut.
Ustilago Tritici Jens.*—loose smut.
On oats—
Ustilago Avenae Jens. and *Ustilago levis* Magn.—oat-smut.

By grouping the smuts in this manner these six species are conveniently divided into three groups. These in turn may be further subdivided according to macroscopic and microscopic characters. For example, the sori (the spore mass of a smut is known as a

* This form on barley is in literature usually named *Ustilago nuda*, but as it is morphologically identical with *U. Tritici* it cannot be considered other than as a synonym, or at least a biologic race. See (1) in " Literature cited " at end of article.

FIG. 1 (LEFT). LOOSE SMUT (USTILAGO TRITICI).
Powdery spore masses in the inflorescences of barley. Natural size.

FIG. 2. LOOSE SMUT.
Remains of infected inflorescences of wheat at harvest-time; the rachis alone remains, the spore mass having been dispersed by wind.

[*Photos by H. Drake.*

"sorus") may be powdery, forming a black mass covering the entire inflorescence (as *Ustilago Tritici*); or may be compact and covered with a transparent membrane, yet visible (as *Ustilago Jensenii*); or may be confined to individual ovaries and difficult to detect on account of being covered by the external opaque seed-coat (as *Tilletia Tritici*).

According to these differences in appearance the smuts may be grouped as under :—

On wheat—

Sori powdery, evident..	*Ustilago Tritici*—loose smut.
Sori compact, inevident	*Tilletia levis* and *Tilletia Tritici*—stinking-smut.

On barley—

Sori powdery, evident..	*Ustilago Tritici*—loose smut.
Sori compact, evident..	*Ustilago Jensenii*—covered smut.

On oats—

Sori powdery, evident .. *Ustilago levis* and *Ustilago Avenae* —oat-smut.

This grouping serves to separate *Ustilago Tritici* from *U. Jensenii* and to separate these two species from the others, but does not separate either *Tilletia levis* from *T. Tritici* or *Ustilago levis* from *U. Avenae*, It has been claimed that these are separable on macroscopic characters. but after extended examination of numerous specimens the writer is

FIG. 3 (LEFT). OAT-SMUT (USTILAGO LEVIS).

The spore masses are held in place by the external glumes. Occasionally the whole inflorescence becomes destroyed by the smut, and this is followed by dispersion of the spores, when the bare rachis alone remains. Natural size.

FIG. 4. COVERED SMUT (USTILAGO JENSENII).

Spore masses in inflorescences of barley. The sori are compact, and when the crop is threshed the spore masses are broken into small portions, those the size of the grains being distributed with the seed.

[*Photos by H. Drake.*

of the opinion that separation may be effected only by the use of the microscope, as follows :—

Spores smooth—	
On wheat	*Tilletia levis.*
On oats	*Ustilago levis.*
Spores rough—	
On wheat	*Tilletia Tritici.*
On oats	*Ustilago Avenae.*

Fortunately, from the control point of view it is unnecessary to separate these species, for all are controlled by the same treatment,

FIG. 5 (LEFT). STINKING-SMUT (TILLETIA TRITICI).

Sori in ovaries of wheat inflorescences. Although infected, these heads appear to differ in appearance little from the normal, save that the glumes are forced apart somewhat.

FIG. 6. STINKING-SMUT.

The glumes have here been removed so as to expose infected grains, and these have been sectioned to show the spore masses.

[*Photos by H. Drake.*

Control measures are dependent on the life-history of the species, and are divisable into two groups according to (*a*) whether the species is disseminated by spores adhering to the exterior of the seed, or (*b*) whether the species is disseminated by hibernating mycelium within the seed.

Smuts disseminated by seed-borne spores are controlled by steeping the seed in a fungicide, or by dusting with a fungicide in powder form; those disseminated by internal mycelium are controlled by steeping the seed in hot water.

The species may therefore be grouped according to the method of treatment as under :—

Hot-water treatment—
Ustilago Tritici—loose smut of wheat and barley.

Steep or dust treatment—
Tilletia levis and *T. Tritici*—stinking-smut.
Ustilago Jensenii—covered smut.
Ustilago levis and *U. Avenae*—oat-smut.

All the species may be treated by the hot-water method, as this treatment would destroy all seed-borne spores in addition to the internal mycelium; but this treatment, owing to the difficulty of application, is usually restricted to those species not controlled by steeping or dusting.

The reader will find full particulars regarding treatments in a series of articles by J. C. Neill published in the *Journal* (see below).

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REPLACEMENT OF TALL FESCUE BY PASPALUM.

The Northern Wairoa flats, which comprise an area of approximately 120,000 acres, are more or less subject to periodical flooding. Around Ruawai there is a considerable extent of country covered with tall fescue. Of recent years, where the flood-waters have remained on the ground for a couple of weeks, the tall fescue has been killed out and paspalum has replaced it. The paspalum recovers after floods, whereas other grasses common to the district, including tall fescue, are killed out. This replacement is going on naturally, and is not being deliberately carried out by farmers. Where paspalum has charge on these areas it withstands stocking better than English grasses, which are often killed out after floods and their place taken by such weeds as pennyroyal. Even where paspalum has been poached through being stocked after heavy rains and floods it holds and even improves. The interesting point, and one of economic value, is the replacement of a bad weed grass (tall fescue) by a very useful grass in the shape of paspalum.

—*T. H. Patterson, Instructor in Agriculture, Auckland.*

OPEN TEXTURE IN CHEESE.

TRIALS IN CURD-CUTTING WITH BRITISH PEG-MILL.

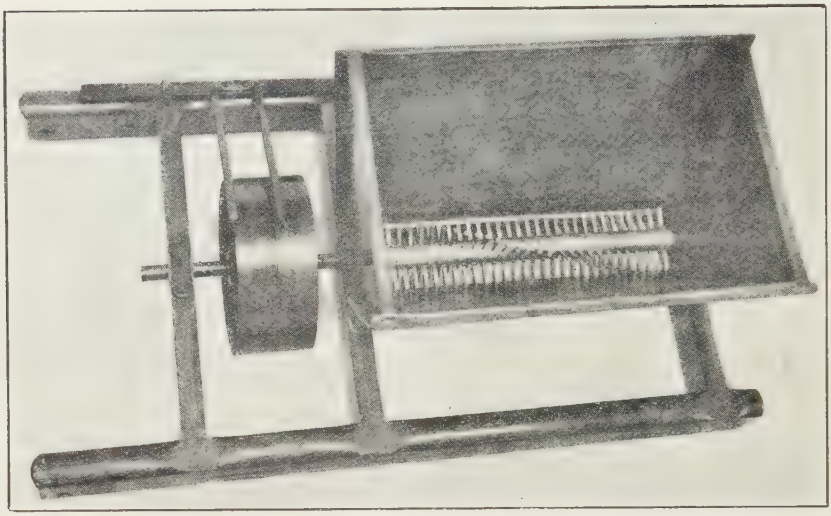
A. McKENZIE, Dairy Instructor, Palmerston North.

THE degree of appreciation which New Zealand cheddar cheese meets with on the British market reflects credit alike on our dairy-farmers and cheesemakers; but when our cheese is compared with that of the highest quality made by the same process in Britain it falls short in flavour and in closeness of texture. The smaller herds, different methods of handling milk, much lesser use of milking-machines, and smaller dairies and factories in Britain are factors favourable to the production of cheese fine in flavour and close in texture. On our part we have ample evidence that the better the condition of the milk delivered to cheese-factories the better the flavour and texture of the resultant cheese. The practice of pasteurizing milk prior to making it into cheese assists our cheesemakers to obtain a better flavoured cheese, but whether pasteurization is resorted to or not the defect of open texture still commonly remains.

Of the many influences bearing on the character of cheese-texture the kind of mill used to cut the cheddared curd is an important one. Mills of various types have been used from time to time, and of these the Harris pattern, locally improved and locally manufactured, has proved the most efficient, and to-day is in general use in New Zealand cheese-factories. It mills the curd quickly with a clean smooth cut, and with the minimum loss of butterfat.

Some little time ago opinion was current to the effect that the texture of our cheese would probably be closer were the curds cut with the type of mill in common use in Britain and known as the peg curd-mill. It was stated that the curd cut by this mill was rough and ragged at the edges, and therefore likely to knit together more closely than curd cut with the local mill. To test this theory a peg curd-mill was imported, and in January last comparative trials with it and the local mill were carried out at a cheese-factory in the Manawatu district.

In carrying out the trials a vat of curd made from pasteurized milk was weighed before milling, and one-half placed in another vat. The first half was milled by the peg mill, and the second by the local mill. The whey from each half of the curd after milling and until five minutes after the cheeses were put to press was collected, weighed, and tested for content of butterfat. The curd after passing through the peg mill was very sticky, lacked firmness, and was most difficult to keep apart. It is safe to say that the curd from an 800-gallon vat would require the combined efforts of four good men to keep it free from lumpiness. The curd cut by the local mill was of the desired firmness, and the handling called for only the customary amount of energy. The butterfat contained in the whey of the curds cut by the peg mill showed nearly 70 per cent. increase over that from the whey of the curds cut by the local mill. The resultant cheese of each milling was examined sixteen days after manufacture, and no difference was noticeable in the texture, but the body of the cheese made from the peg-milled curds appeared to be much drier.



THE BRITISH PEG CURD-MILL USED IN THE TRIALS (VIEWED FROM ABOVE).
[Photo by H. Drake.

The experiments evidenced that the use of the peg mill supplies no remedy for the defect of open texture in cheese. The remedy must be sought for elsewhere. Our dairy-farmers would therefore be well advised to devote all possible attention to the delivering of milk to cheese-factories in the cleanest, coolest, and freshest condition; and our cheesemakers to follow methods of manufacture known to give the best results. The production of cheese of the quality asked for by the British importer and retailer depends on just how well the dairy-farmer and cheesemaker perform their share of the work. With each doing his best the making of cheese of the right flavour and texture is easily possible.

CHECKING QUALITY OF FERTILIZERS.

MANY farmers may still be unaware that the Department of Agriculture is desirous of their assistance in checking the quality of the fertilizers on the market, by the forwarding of samples by them for analysis. No fee is charged for this work, and in the event of any deficiency being found an official sample of the fertilizer will be taken from the vendor's store by a departmental officer. This will enable legal proceedings to be taken should the results warrant it. For farmers' samples a portion of the fertilizer should be taken from each of a number of bags, and the portions thoroughly mixed together. Finally, a portion weighing about 1 lb. may be put into a clean, dry tin, and posted with the invoice certificate (or a copy of it), addressed to the "Agricultural Chemist, Dominion Laboratory, Wellington." It is essential that *the invoice certificate should accompany any sample sent*, or, if no certificate has been supplied, the name and address of the vendor and the brand of the fertilizer should be stated.

—*Chemistry Section.*

TESTING OF PUREBRED DAIRY COWS.

THE NEW ZEALAND CERTIFICATE-OF-RECORD RULES AND RETURNS.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

AFTER it had been decided, in 1913, that the Department of Agriculture should establish a system of authenticating the records of purebred dairy cows in New Zealand the next move was to formulate a set of rules governing the scheme. This at first thought may not appear a very difficult matter. We had, of course, closely studied what was being done in other countries, and with ideas based partly on the experience of others, partly original, we framed our first set of "Rules for the Semi-official Testing of Purebred Dairy Cows." This was in the spring of 1912. But each country, with its own peculiar conditions, has its own distinct requirements, and the first season's practice disclosed several omissions and irregularities, several rules which were either incomplete or which permitted an interpretation different from the intention, and even evasion. So, almost annually, it has been found advisable to make alterations and additions. Now, however, we feel that our rules are approaching that stage when they are as nearly "watertight" as it is possible to make them, and that nothing less than some marked change in general conditions, and impossible to foresee, can necessitate anything beyond minor amendments.

The rules governing the certificate-of-record* testing of purebred dairy cows are now widely known among New Zealand breeders of such stock, but for the information of other *Journal* readers who are interested in the subject, and as a general record, the latest issue of the rules (June, 1924) is here reprinted.

Occasional correspondence received at this office from breeders goes to show that some of the rules are not entirely understood. This being so, an explanation is given in this article of some of the more salient restrictions, and an indication of the object behind them. Further, in order that breeders may know something of the C.O.R. system from the point of view of the office a section treating with the handling of returns for C.O.R. cows has been included.

COMMENT ON THE RULES.

The first rule of special importance is No. 1 (*b*). The object of restricting the period between calving for commencement of test and calving prior to calving for test, in the case of cows four years old and over, was to prevent records being made under the advantage of a long rest as the result of cows being kept dry for the season preceding the season under test.

* The term "certificate of record" replaced the original "semi-official" in the year 1915. The latter term, however, is still often used informally by breeders, Press writers, &c.

The office of the Dairy Division is often put to considerable trouble through those desirous of testing cows not conforming to that section of Rule No. 2 (*a*) which provides that application shall be made at least a fortnight before due calving-date. There is more than one reason for the strict enforcement of this clause. First, advice prior to calving keeps us informed of what provision we shall require to make for carrying out the monthly visit. Second, it leaves time to adjust any irregularities in the making-out of the application form. Third, and most important, it enables us to keep a check on the date of calving for commencement of test; otherwise there would be nothing to prevent an unscrupulous breeder from entering a wrong date of calving prior to the true day, and recording fictitious weights for the period between the false and actual date, with the object, of course, that such milk-weights should give the cow a greater credit than would the yield for a similar period at the end of the season. By being in possession of the expected date of calving, however, an officer of the Department can make a check visit about that date in any case where such may be considered necessary.

The next rule which invites discussion is No. 3 (*a*). Breeders, despite this rule, sometimes complain because allowance is not made in the case of milk-weights unrecorded while cows under test are away from their usual headquarters. The point is that the C.O.R. milk-weights are a record of what the cow actually produces during the period she is on test, and not what she might have done under certain conditions. A cow which is away from her usual surroundings is usually adversely affected, and an average of her normal milk-weights would naturally give a distinct advantage. Apart from this, were there no rule on this point there would be nothing to prevent a dishonest breeder from purposely not recording milk-weights for a protracted period and claiming allowance under the excuse that he was unable to record weights or that his cow was affected through being away from the home farm.

Rule No. 3 (*f*): Without this restriction a milker might use a substance which would drip into the bucket and by chance find its way into the test-bottle and so enhance the butterfat content. The possibility, is, of course, remote, but this rule was considered necessary.

No. 4: It is desired that feeding of C.O.R. cows shall not include anything which will artificially improve the yield or test, thus placing a false estimate on the cow's ability.

No. 7 (*c*): The Dairy Division has met with instances of breeders wishing to refuse certificate on the ground that a certain record has not been up to expectation, thus lowering the average of their tested cows, or in some other way being considered an unsatisfactory advertisement. The Division's desire is not to authenticate a few outstanding performances, but rather to get as many cows as possible certificated, and consequently their male relatives backed by butterfat records. A certificate cannot be issued until the owner makes statutory declaration to all weights taken and all incidents of the test occurring while the cow was in his possession. We are then in a proper position to issue the certificate and publish the record,

No. 8: This rule is self-explanatory. All that need be said is that the calving restrictions are one of the strongest points of our testing system. They prevent abnormal performances as the result of cows being kept dry for a protracted period prior to test. Occasionally we have heard it said that fifteen months is too long a period to set between calvings, and that this should be reduced to a year, so as to conform to usual dairy-herd conditions. The main object behind this rule, however, is to bring about a longer average lactation period. Readers may be surprised to learn that for 151,214 ordinary herd cows on test in the 1923–24 season, and for which we have figures, the average cow milked less than eight months. That is to say, there were four months in which she was doing nothing by way of producing butterfat. We recognize that both the cow and the milker should have an annual rest, but ten months' work and two months' rest should be adequate. The primary motive in bringing in the C.O.R. testing scheme was to enable breeders to supply proven dams and sires from which the ordinary dairyman could draw for the purpose of building up his herd. It is reasonable to suppose that by developing a cow which can maintain her yield for twelve months, and by mating bulls from such dams with ordinary herd cows, the result should be a longer average milking-period, this meaning, of course, a distinct asset to the herd-owner and the country generally.

No. 9: The strong points of this rule are the restrictions to exactly twenty-four hours between the first and last milking of the testing officer's visit, and the testing separately of the samples. The object of the clause on stripping should be apparent. By leaving a cow unstripped at the preliminary milking of the visit the following milking from which a sample is taken would possibly benefit in both quantity and quality.

No. 10: It will be seen that the second portion of this rule provides that the 365-day milking-period for test shall commence not later than the day after calving. This, in conjunction with the restriction for subsequent calving, makes the test conditions conform more closely to usual daily herd practice. Originally it was made compulsory to commence the record on the day of calving. Obviously, however, a cow calving at early morning would have practically a full day's advantage over one calving in the evening, and the rule was altered in consequence.

No. 18: We have endeavoured as far as possible to prevent misrepresentation in the matter of advertising records of C.O.R. cows. Unfortunately, occasionally a breeder and sometimes an odd firm interested in the sale of purebred stock do not uphold the Dominion's reputation for accuracy and fair statement.

For the rest the rules will speak for themselves. We firmly believe that breeders as a whole realize the intention behind them, and, further, that they recognize the need for those rules which are restrictions and penalties. The Department aims at the highest possible degree of accuracy and of efficiency. A certificate easily gained is of no great value, but with the help of breeders and others interested we feel that the reliability of certificates based on the present C.O.R. rules can be maintained.

PREPARATION OF C.O.R. RETURNS.

Probably very few breeders who fill in and post to the office of the Dairy Division each month the milk-weights of their test cows are acquainted with the routine carried out before the results of those weights are returned to them in the form of monthly statements of yield. A brief outline of the procedure is as follows:—

The first step is to compare the figures on the form supplied by the testing breeder with the three and a half days' weights reported by the testing officer. Having ascertained that this matter is in order, the weights for the whole of the month are studied in conjunction with those for the testing officer's check milkings. This tells whether or not the officer has authenticated the weights recorded by the owner. The next move is to add the individual milk-weights, and thus check the daily totals entered by the owner. After this comes the checking of the total for the month. The average test is then entered on the weight-sheet, and the pounds of butterfat multiplied out.

A step must now be retraced and reference made to the test. When the testing officer's report on his monthly visit is received at the office all computations connected with that form are checked. The average test for each cow is then compared with the preceding tests with a view to detecting abnormalities. If the test is abnormally high or low the figuring of the return is held over pending receipt of the test results for the following month; or, if it is considered warranted, the testing officer is asked to make a special retest within the same month. This averaging and retesting causes some concern among breeders, many being inclined to consider that the Dairy Division has a habit of doing more cutting down than averaging up. Breeders may be assured that we set a percentage of variation, and whether there is a drop or a rise the case receives exactly the same treatment.

To return to the milk-weight sheet: After the butterfat is worked out, the figures representing the total milk-weights, the average test, and the butterfat for the month are transferred to a permanent record-card. The yield of milk and butterfat is brought forward to the end of the month under review and checked. The owner's monthly return is typed and checked, and the statement despatched, a note of the date of despatch being entered in a list. This, of course, is only one branch of the Dairy Division's clerical work.

Further reference may be made to variations in milk-weights. A special list is kept on which is entered the name of the breeder and cow in every case where the milk-weights have not been authenticated by the testing officer. If the breeder has been able to give the officer a reasonable explanation for decrease in milk-flow at the time of the officer's visit this explanation is taken into consideration. If the same cow is down in milk-weights at the time of the officer's visits for a protracted period a chart based on the daily weights is run out. The officer's check-weights are linked up with a direct line, and the result makes it clear whether or not the owner should receive a certificate.

Two charts are shown herewith, each based on an actual case. The days in milk are shown along the horizontal plane, as marked, while the daily milk-weights are plotted against the perpendicular scale. The dates of the testing officer's check visits are joined by a dotted line; the unbroken line joins the milk-weights as recorded by the

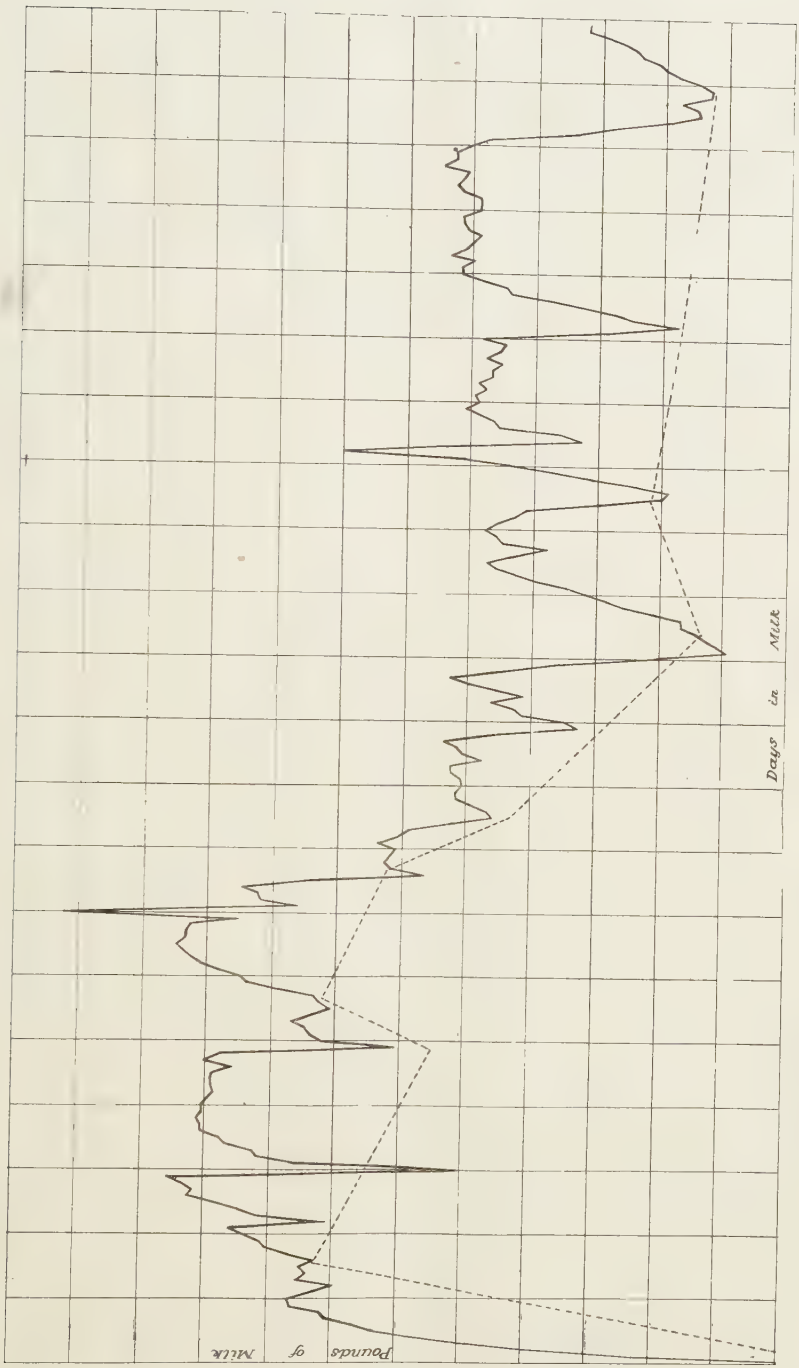


FIG. 1. CHART OF UNAUTHENTICATED DAILY MILK-WEIGHTS AS SUPPLIED BY OWNER OF A COW ON C.O.R. TEST.

In this case the test was discontinued and a certificate refused. For obvious reasons the milk-weight figures themselves are omitted from the reproduction. The unbroken line joins the owner's weights, the dotted line the testing officer's weights.

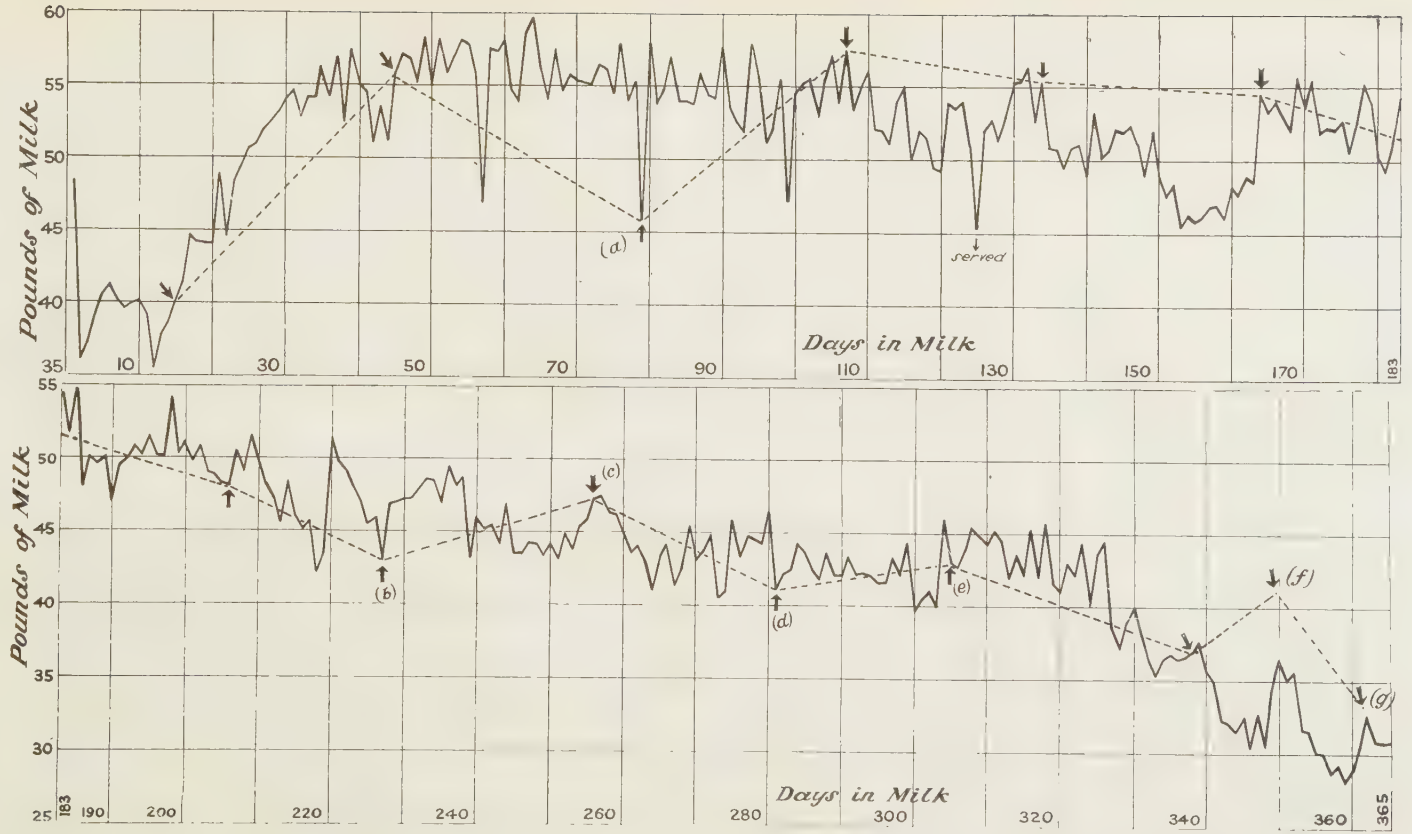


FIG. 2. GOOD EXAMPLE OF CLOSE AUTHENTICATION OF OWNER'S MILK-WEIGHTS BY TESTING OFFICER.

This chart covers the testing-period, in 1923-24, of Vivandiere, champion Jersey cow of New Zealand. The days of the tester's check weighings are indicated by an arrow-head Letters (*a*) to (*d*) signify that tester has reported to head office a satisfactory reason for decline in milk-weights on or just preceding date of his visit. As regards (*f*) and (*g*), where point indicating check weight on day of inspection visit is apart from main line of chart, in these cases tester happened to commence sampling at evening milking, and thus, while his figures would be for an evening and a morning milking, owner's weights as linked up by the unbroken line are on basis of normal day.

owner. Fig. 1 is based on the milk-weights (up to date of discontinuance of test) of a cow which was refused certificate. It is recognized that there are occasions when the testing officer chances to visit the farm just at a time when, through natural causes, a cow is down a little in weights. It is reasonable to expect, however, that the officer should, on a fair proportion of his visits, confirm the milk-yield as indicated by the owner's weights for the remainder of the month. In the Fig. 2 chart it will be observed that the line linking the testing officer's check passes practically midway through the lines joining the owner's daily milk-weights. Here and there a sudden temporary rise or fall will be noticed, but this is reasonable and natural. In Fig. 2, which is a common type of chart for cows whose yield has been unauthenticated, it will be seen how the dates of the officer's visits are the lowest points on the chart, and how the owner's weights gradually climb to their highest point midway between the officer's calls and gradually descend to the next visit.

The foregoing will serve to indicate how every care is taken and every endeavour made to place New Zealand certificates of record above reproach.

RULES FOR THE CERTIFICATE-OF-RECORD TESTING OF PUREBRED DAIRY COWS.

1. (*a.*) The Dairy Division of the Department of Agriculture will assist in the certificate-of-record testing of only such cows as are duly and properly registered in the New Zealand herd-book of the breed to which they belong.

(*b.*) No four-year-old or mature cow shall be eligible for entry unless she shall have dropped a living or mature calf within 455 days prior to the calving for commencement of test.

Application for Testing.

2. It shall be the duty of every owner offering a cow for test—

(*a.*) To forward to the secretary of his breeders' association, at least a fortnight before due calving-date, and on a form to be supplied by the Department, an application properly filled in with the particulars required by such form: Provided that inability or failure to furnish the exact age shall not necessarily be a bar to entry; but all cows the age of which cannot be so ascertained may be required to qualify as mature cows, or as cows of such age as the Director of the Dairy Division, having regard to all the circumstances of the case, shall deem just. If he so desires, the Director shall be supplied by the owner with a veterinary certificate regarding age.

(*b.*) To forward payment of testing fees to the Director of the Dairy Division, Wellington, before the cow or cows entered for test commence their period of test.

Recording and forwarding of Milk-weights.

3. (*a.*) The owner, or his agent, shall weigh and record the weight of each and every milking of the cow during her testing-period, and it is hereby expressly provided that this shall include all milkings during the time the cow may be attending any show or otherwise away from the owner's farm. Record blanks for this purpose shall be supplied by the Department.

(*b.*) The owner shall forward to the Director of the Dairy Division, Wellington, within one week after the end of each month, a legible copy in ink of this record.

(*c.*) The owner shall not fill in any space occasioned by any weighing being inadvertently or otherwise missed, but when forwarding the monthly weights shall include an explanation of such omission, and the Director of the Dairy Division shall determine what allowance, if any, shall be made.

Scales.—Milking-machines.—Lubricant for Milker's Hands.

(*d.*) The scales used shall meet with the approval of the Director of the Dairy Division.

(*e.*) Milking-machines may not be used on the releaser principle.

(*f.*) Where the milker milks with dry hands—*i.e.*, without using milk as a lubricant—the use of vaseline, petroleum-jelly, or other such substance may be permitted, provided that in the opinion of the testing officer the quantity so used is not excessive. If milk be used for this purpose no other lubricant shall be permitted.

Milking-hours.

(*g.*) It shall be the duty of an owner, at the request of the Director of the Dairy Division, to so arrange his milking-hours that the testing officer may take the check weights and samples on the same dates as for one or more breeders in the vicinity.

Feeding.

4. The owner shall see that no milk or milk product is fed to any cow on certificate-of-record test, and, excepting as remedies in case of sickness, no condiments, condition-powders, or drugs shall be given.

Dates of Service.

5. The owner shall indicate on the first monthly weight-sheet forwarded the Department after service the date of the first and any subsequent service during the testing-period.

Notification of Calving subsequent to Test.

6. The owner shall, on the day of calving subsequent to test, notify the Director of the Dairy Division of such calving. This rule shall also apply to premature calving.

Declaration.—Change of Ownership during Testing-period.

7. (*a.*) It shall be the duty of the owner after the cow has calved subsequent to test to make declaration, on a form to be supplied for that purpose by the Department, of the weights of milk given by such cow in each month or part thereof during such testing-period, and of her name, registered number, age, date of calving prior to test, date of calving for period of testing, date of service, and date of calving subsequent to test.

(*b.*) Should a cow under this test be sold, and the purchaser desire to continue such test, it shall be the duty of the vendor to forward to the Director of the Dairy Division a declaration indicating all relevant particulars required by the form of declaration referred to in (*a*) above, and which have occurred prior to the time of transfer of ownership.

(*c.*) In all cases declaration must be completed and returned to the Director of the Dairy Division within thirty days of date of despatch by the Dairy Division. If the owner fails to comply with this rule the Department may refuse acceptance of further applications.

Qualifications relating to Dates of Calving.—Premature Calving.

8. Every cow, in order to qualify for a certificate, must drop a mature calf within 455 days after the calving for commencement of test: Provided that, in the case of a cow aborting or calving prematurely within this 455-days period, the cow must have been served so as to drop a mature calf within 455 days. Premature calving shall terminate the testing-period. (The period of gestation shall be deemed to be 282 days.) It is also provided that prior to the date of abortion the Director of the Dairy Division must have been advised by the owner or his agent of the date of service.

Rights and Duties of Testing Officer.

9. The testing officer of the Department shall have right at any time to visit the farm on which the cow is under test, and he shall have the right to perusal of milk-weights on demand. He shall make his testing-visits as nearly as possible every month. For the first milking during his visit he shall take the weight but no sample, and he shall take the time at which the milking is made. For the following two milkings (or three, according as the cow is milked twice or three

times daily) he shall take check weights and samples, and the last milking shall be twenty-four hours later than the first milking of his visit. Each milking shall be tested separately, and the samples shall be kept under lock and key or sealed until tested. They shall be tested by a departmental officer. No cow shall be tested when her yield is less than 4 lb. of milk per day. No cow shall be tested until a period of at least ninety-six hours has elapsed between calving and the taking of the first sample.

Stripping.

The testing officer shall try the cow's teats after the preliminary milking to see that such cow has been stripped clean by the milker, and he shall have the right so to do for any cow on test at any milking at time of his visit.

Abnormal Tests.—Method of calculating Production.

10. The percentage of butterfat for the month shall be that as calculated for the day's test from the total weight of milk and butterfat produced during the twenty-four hours. Should the average per cent. fat found in the milk during any monthly test be considered abnormal by the Director of the Dairy Division, he may reject that test and use the average per cent. fat obtained from the preceding and succeeding months as a basis for computation of the fat-production for that month.

The monthly fat-production of a cow shall be calculated by figuring the total milk credit for the month at the average test for the day obtained by the testing officer. The annual production shall be calculated by totalling the production of pounds of milk and butterfat for each month or part thereof during one lactation period, and not exceeding 365 days, commencing not later than the day after calving. The first return of monthly milk-weights shall be accepted as indicating whether the 365-days period commences on the day of calving or the day after calving.

Discontinuing Test.

11. The testing of a cow may be discontinued by the Department and without refund of testing fee, provided—

(*a.*) That such cow be not pregnant sufficiently early to drop a mature calf in time to qualify for a certificate on a 282-day gestation period;

(*b.*) That after 150 days on test she has produced less than one-half her requirement for qualification for C.O.R., or is, in the opinion of the Director of the Dairy Division, unlikely to produce the minimum amount of butterfat required for certificate from a cow of her age;

(*c.*) That in the opinion of the Director of the Dairy Division the milk-weights as forwarded to this office have not been authenticated;

(*d.*) That in the opinion of the Director of the Dairy Division the testing breeder has not afforded the testing officer all reasonable facility for carrying out his duties;

(*e.*) That any of the duties prescribed by these rules for the owner of a cow on test have been contravened or not given effect to.

The Department may refund the testing fee and discontinue the test for any owner who, on request by the Director of the Dairy Division, declines to arrange his milking-hours so that a testing officer may visit one or more other testing breeders on the same dates.

Acceptance of Application.

12. The Director of the Dairy Division may decline acceptance of application in any case where such testing cannot conveniently be undertaken by the existing staff of testing officers, and he may decline acceptance of application from any owner who at any time has been refused certificates on account of breach of rules, or on account of the recorded milk-weights not having been authenticated, or the testing of whose cows has been discontinued on account of breach of these rules.

Testing Fees.

13. For the first cow or heifer to be tested on one farm and commencing test after the 1st April of each year the fee shall be ten guineas, and for each subsequent cow or heifer commencing test within that same year the fee shall be three guineas: Provided that a period of not more than six months shall elapse between the date of calving of the first and last cow or heifer entered. This shall be the charge for the work done during one lactation period only, and not exceeding 365 days, commencing not later than the day after calving.

In the case of transfer of ownership during the testing-period the testing fee shall be as follows: If the cow which is transferred during her testing-period be the only cow on test at the farm of the vendor, no further fee shall be payable If the purchaser of such cow has other cows on test at the time of transfer, no further fee shall be payable, provided the completion of the testing of any purchased cow does not continue beyond the last test for any cow then on test at the farm of the purchaser. In all other cases the fee payable shall be at the discretion of the Director of the Dairy Division.

First-class Certificate.

14. The owner of every heifer or cow which shall have produced the minimum pounds of butterfat required by an animal of her age and class as determined by Schedule A appended shall, on compliance with all the rules hereinbefore contained, be entitled to a first-class certificate.

Second-class Certificate.

15. A cow or heifer duly accepted for test on the above rules shall be deemed to have qualified for a second-class certificate provided—

(*a.*) That she produced the butterfat requirement for her age;

(*b.*) That she dropped a mature calf during the period between the 456th and 485th days, inclusive, after commencement of test;

(*c.*) That in the opinion of the Director of the Dairy Division the owner of the cow or heifer has done all within reason to have such cow or heifer qualify on subsequent calving for a first-class certificate—*i.e.*, within 455 days after calving for commencement of test.

Re-entry for Second-class Certificate.

16. A cow qualifying for a second-class certificate shall be eligible for re-entry for a second-class certificate during the following lactation period, and shall be granted such certificate, provided that, with the exception of the time allowed for previous calving, the incidents of the test shall conform to the requirements of a first-class certificate.

Non-issue or Cancellation of Certificate.—Issue of Certificate.

17. (*a.*) No certificate, either first or second class, shall be granted if in the opinion of the Director of the Dairy Division the milk-weights as forwarded by the owner have not been authenticated, and a certificate may be cancelled and the record expunged if it subsequently be found that in the opinion of the Director of the Dairy Division, and of a majority of the executive of the breeders' association of which the owner is or was a member, the record was not made in accordance with the rules.

(*b.*) In every case where a cow qualifies for certificate of record such certificate shall be issued and particulars entered in the records of the Department, and such particulars shall also be forwarded to the secretary of the breeders' association concerned.

Advertising of Records.

18. Whenever publishing or advertising the record of any cow which is on test, or which has been on test, the particulars used shall, unless otherwise stated, be strictly in accordance with official statement issued by the Director of the Dairy Division. No figures applying to a record on which a cow has been refused certificate, or whose testing has been discontinued by the Department, shall in any case be used; or, if any figures for such cows be in print at the time of notice of discontinuance by the Department, such figures shall immediately be withdrawn.

In the event of sale, either privately or by public auction, of any cow whose testing has been discontinued by the Department, or whose certificate has been cancelled, the owner or his agent shall, before offering such animal for sale, announce that the figures supplied by the Dairy Division and appearing in the catalogue, or in any way previously advertised, are void.

Breeders owning a cow with a second-class certificate shall, whenever advertising or publishing the record, use the description "II Class C.O.R." immediately preceding the butterfat figures for such record—thus, "II Class C.O.R., 555 lb. fat." Any breeder failing to do this may be refused further certificates.

Any breeder or owner failing to comply with the foregoing may be refused certificates for any cows which may be on test at the time of breach of these regulations, and may also be debarred the right of entering further cows for test.

Interpretation of Rules.

19. In the event of any question arising as to the administration of the certificate-of-record test, or as to the interpretation of the rules governing the same, the Director of the Dairy Division shall consider the case, and his decision shall be final.

SCHEDULE A. CERTIFICATE-OF-RECORD TESTING OF REGISTERED PUREBRED DAIRY COWS.

CLASSES.

The classes for certificate-of-record cows as agreed upon by the respective breeders' associations are as follows :—

Jerseys.

Cows 2 years 92 days and under shall be classed as junior two-year-olds.
Cows 2 years 93 days and under 3 years shall be classed as senior two-year-olds.
Cows 3 years and under 4 years shall be classed as three-year-olds.
Cows 4 years and under 5 years shall be classed as four-year-olds.
Cows 5 years old and over shall be classed as mature.

Friesians and Milking Shorthorns.

Cows 2 years 183 days and under shall be classed as junior two-year-olds.
Cows 2 years 184 days and under 3 years shall be classed as senior two-year-olds.
Cows 3 years to 3 years 183 days shall be classed as junior three-year-olds.
Cows 3 years 184 days and under 4 years shall be classed as senior three-year-olds.
Cows 4 years to 4 years 183 days shall be classed as junior four-year-olds.
Cows 4 years 184 days and under 5 years shall be classed as senior four-year-olds.
Cows 5 years old and over shall be classed as mature.

Ayrshires and Red Polls.

Cows under 3 years old shall be classed as two-year-olds.
Cows 3 years and under 4 years shall be classed as three-year-olds.
Cows 4 years and under 5 years shall be classed as four-year-olds.
Cows 5 years old and over shall be classed as mature.

YIELD OF BUTTERFAT REQUIRED FOR CERTIFICATE.

A heifer starting a test on the day she is two years old or before that date shall be required to give the amount of butterfat required of a two-year-old. For every day she is over two years old she shall be required to give 0·1 lb. of fat more than her requirement as a two-year-old. This daily increase shall continue until the cow is five years old, when she shall be required to give the minimum for a mature cow. Thus :—

If two years old at the commencement of the test, 240·5 lb. fat.
If three years old at the commencement of the test, 277·0 lb. fat.
If four years old at the commencement of the test, 313·5 lb. fat.
If five years old at the commencement of the test, 350·0 lb. fat.

REMINDERS TO BREEDERS WITH COWS ON CERTIFICATE-OF-RECORD TEST.

Preserving Monthly Milk-weights.

Loss of monthly milk-weights in the post sometimes occurs. Breeders are strongly advised to retain a copy of all milk-weights forwarded us until they receive from us their returns for the month. This will assist in protecting the cow's record against loss of credit.

Breeders should communicate with the Director of the Dairy Division if monthly statement of yield is not to hand within the month following that for which weights were taken.

Recording of Milk-weights at Shows.

Breeders who are exhibiting at shows cows which are on C.O.R. test should be careful to see that all milkings at the shows, or on the way to or from the shows, are weighed and recorded as usual. The Department does not promise in any way to take notice of any milk-weights which are not duly recorded on such occasions.

The Director of the Dairy Division would take it as a favour if breeders would advise him of the dates on which they propose to show their cows, so that he can make arrangements with the testing officer for the monthly test.

Notification of Dates of Service.

It is in the interests of breeders to see that date of first and any subsequent service is indicated on the first monthly weight-sheet forwarded the Director of the Dairy Division after service.

If a cow aborts after having produced her butterfat requirement a certificate may be granted, provided the Director of the Dairy Division has previously received advice of the date of satisfactory effective service.

Notification of Calving-dates subsequent to Test.

Notification of calving-dates after testing-period should be made by telegram if within a fortnight of time-limit (455 days after commencement of test for first-class certificate, or 485 days for second-class certificate), otherwise notice by letter is sufficient. The onus of notification of calving-dates subsequent to test rests with the owner.

For purposes of record the Director of the Dairy Division will be pleased to receive notification of all calving-dates, whether beyond the last day for certificate or not.

FULLER'S TEAZLES FOR WOOLLEN-MILLS.

At the present time all the supply of teazles used by the local woollen-mills in dressing certain classes of woollen goods is imported from Europe. It appears that when the Mosgiel Company's works were established many years ago seed of the fuller's teazle (*Dipsacus fullonum*) was imported, and the plant grown for a while on the Taieri Plain, but its cultivation was not maintained. At the suggestion of Hon. G. M. Thomson, M.L.C., of Dunedin, the Department of Agriculture procured some seed from England, with a view to testing its economic production. The seed was sown in the spring of 1923 in the grounds of the Department's depot at Christchurch, and, the plant being a biennial, the crop ripened in the summer of 1924-25. The following brief report by Mr. F. E. Ward, Instructor in Agriculture for Canterbury, gives information of interest:—

"Some plants remained in the original rows in which they were sown; others were transplanted into rows 2 ft. apart and 1 ft. between the plants. The small plants transplanted well, and all grew to a height of about 6 ft. A large number of teazles set, about half of which were too small for commercial size. From counts taken from a few plants, I estimate that anything from 100,000 to 200,000 commercial teazles could be grown per acre. The Kaiapoi Woollen Company imported last year over 71,000 teazles, the price being £2 15s. per 1,000 in England and £3 12s. per 1,000 landed here. These were procured from a Leeds agency, but, like the bulk of commercial teazles, were grown in southern France. Blankets, rugs, and tweeds are the goods on which teazles are mainly used. Four machines are installed at Kaiapoi, and on each of these there are 90 teazles in a row, and about 24 rows, or, in all, over 2,000 teazles on a machine. As there are ten mills in operation in the Dominion the annual consumption must be large. The teazles grown at the Christchurch depot compare favourably with the imported article, though they were on this occasion allowed to get rather too dry before gathering. Undersized heads are of no use, but larger ones can be cut if they are of about the same diameter. It would appear that teazles could be profitably grown in New Zealand, but the country's requirements could be supplied by one or two growers."

Mr. Thomson is further interesting himself in the matter, holding that even small matters of this kind merit attention in the Dominion's economic interest.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTS AT SOCKBURN AND TAI TAPU, 1923 and 1924.

F. E. WARD, H.D.A., Instructor in Agriculture, and A. W. HUDSON, B.Agr., B.Sc., Assistant Instructor in Agriculture, Christchurch.

In the more climatically favourable districts of New Zealand top-dressing of pastures has been for many years an established practice, but under Canterbury conditions of light rainfall and short-rotation pastures top-dressing has not generally been practised. In co-operation with the Canterbury Soils Improvement Committee, carefully planned experiments were arranged in 1923, and were continued by the Fields Division in 1924. The results of those undertaken in 1923 are now recorded, one experiment being continued into the second year.

MANURES USED.

The manures used were as follows, the quantity stated being per acre in each case :—

Season 1923 : (1) Superphosphate (42–44), 2 cwt. ; (2) superphosphate (42–44), 1½ cwt., plus dried blood, ½ cwt. ; (3) basic super (40–43), 2 cwt. ; (4) basic super (40–43), 1½ cwt., plus dried blood, ½ cwt.

Season 1924 : As in the case of the manures used in the wheat manurial experiments, results of which were published in the April *Journal*, it was decided to apply equal amounts of phosphate (2 cwt.) on all plots, the blood being an addition on those plots where it was used. The object in the selection of the manures was to test soluble phosphate (super) against the less soluble phosphate (basic super), and to note the effect of dried blood used in conjunction with these phosphates.

SEASON 1923 EXPERIMENTS.

(1.) *On Farm of T. Bloor, Sockburn*

The soil of this area is a rich silty loam. The paddock was sown down in September, 1921, with a mixture of 30 lb. perennial rye-grass and 5 lb. cow-grass. Hay was taken off in 1922, the paddock being then grazed until closed in October, 1923, for the top-dressing experiment. The manures were applied on 6th September, 1923, and the plots weighed early in December. Each of the plots was four widths of the drill and the length of the paddock. The four manures mentioned and a control plot (no manure) constituted a series. There were four series, giving twenty strips in all.

On certain portions of the field distinct differences between manured plots and controls could be observed before harvest, while on other parts no differences in growth were discernible.

Six areas of $\frac{1}{259}$ acre were weighed on each plot, giving twenty-four weighings in each treatment. The ratio of hay weight to green weight was not determined, but, in light of estimations made this year, it may safely be assumed that this would be about 1 to 3, and for purposes of evaluation of increases the hay weight is regarded as being one-third of the green weight. The table which follows shows the results obtained.

Table 1.—Result of Top-dressings on Farm of T. Bloor, Sockburn.

Treatment.	Yield of Hay per Acre.	Increase due to Manure.	Value of Increase at £5 per Ton.	Cost of Manure per Acre.	Net Profit per Acre.
	Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	1·29	0·13	*	*	*
Super and blood ..	1·38	0·22	1 2 0	0 17 5	0 4 7
Basic super	1·38	0·22	1 2 0	0 13 6	0 8 6
Basic super and blood	1·32	0·16	0 16 0	0 16 8	Loss 8d.
Control	1·16	..	..	..	..

* Increase not significant. The application of the statistical method enables the investigator to estimate the chances of any differences which occur being real and due to the treatment and not to chance variation. When a difference occurs, and the odds in favour of such difference being a real one are greater than 30 to 1, the difference is here said to be "significant." If a difference occurs with chances of less than 30 to 1 in its favour, such a difference is spoken of as being "not significant." To simplify this article the odds are omitted, and differences which are "not significant" are noted as such. Any non-significant difference must be regarded as due to mere chance variation in the crop, or else an insufficient number of weighings has been taken to reduce the "probable error" sufficiently to permit the difference being measured with certainty, in which case the result must be regarded as showing no difference.

The results as given in the table show that only a small margin of profit can be claimed from the use of two of the manures. These results, however, only record the effect on three months' growth, and if the increase in hay pays for the manure it is highly probable that the benefits will be quite considerable ultimately.

A study of the weighings taken twelve months later in W. G. Macartney's experiment showed a very definite belated effect from the manures of 1923 application. A consideration of the 1924 experiment on this farm and shown later herein indicates that the application of these manures has paid handsomely. The lateness of sowing, coupled with the extremely dry conditions which prevailed during the growth of the hay crop, no doubt limited the effect of the fertilizers on the early growth.

(2.) *Experiment on Farm of W. G. Macartney, Tai Tapu.*

The soil of this area varies from a clayey loam at one end to a silty loam at the other. Sowing of the pasture took place in the autumn of 1922, the mixture consisting of 20 lb. Italian rye-grass, 20 lb. perennial rye-grass, and 6 lb. cow-grass per acre. The manures for the experiment were applied early in September, 1923, and the plots weighed in December. The lay-out of the plots was similar to that in T. Bloor's experiment, and may be seen in the accompanying diagram (Fig. 1—season 1923 plots).

In this experiment ten areas of $\frac{1}{259}$ acre each were weighed in each strip, giving forty weighings in each treatment. Since the differences in yield which occurred are in no case significant, only the green weights per acre are shown. In this case, however, the chances of super being better than control are 22 to 1. We do not accept these odds as certainty, but regard them as indicating a good chance of the difference being a real one.

The yields on the different treatments were as follows, the amounts stated being green weight per acre: Control, 2·83 tons; super, 3·26 tons; super and blood, 2·94 tons; basic super, 2·73 tons; basic super and blood, 2·83 tons.

These figures will be found very interesting when the reader has perused the results of the weighings made on this area in 1924. From the 1923 figures, however, it must be concluded that in the first hay crop the application of the manures did not pay. The appearance of the paddock later in the season, when the subsequent crop of red clover was growing for seed, showed that the manures were having some effect. Mr. Macartney was of the opinion that distinct differences could be seen in places.

On 4th August, 1924, the field was visited by the writers. A casual examination revealed the fact that certain plots had a much greater amount of clover stubble on them than the others. These plots proved to be controls, and so distinct was the difference that the edge of each control could be seen from one end of the paddock to the other. A closer examination showed a much better sole of rye-grass on the manured areas; the grass looked much darker and more vigorous. No difference could be detected between the clover contents of the plots. The extra stubble on the control areas shows a decidedly smaller amount of grazing on these plots, indicating in all probability less growth and a lower palatability. Undoubtably this is an important factor, and one the value of which cannot be readily determined.

Mr. Macartney having signified his willingness to give the field further trial, it was then decided to repeat the experiment as described below:—

SEASON 1924 EXPERIMENT ON FARM OF W. G. MACARTNEY.

As indicated previously, a crop of red clover for seed was taken off the area after the hay crop of 1923. In 1924 the main constituents of the pasture were perennial rye-grass, suckling-clover, red clover, and white clover; and in patches creeping-fog and black medick had made their appearance. The plan of experiment shown in Fig. 1 was decided upon in order to try and ascertain the following points: (1) The belated effect of the 1923 dressing on the yield of 1924; (2) the effect of dressing for two consecutive years with the same manures; (3) the effect of the 1924 dressings on the controls of 1923; (4) the effect of the 1924 dressing on top of that of 1923. As will be seen, the dressings of 1924 were made across those of 1923.

The manures were applied on 20th August, and the paddock was closed for the hay crop on that date. On 23rd October the plots were closely examined, but no differences between manured plots and controls could be distinguished. At this stage it appeared as though the results would be a repetition of those of the previous year.

The area was cut and weighings made on 2nd and 3rd December, at which time what appeared to be slight differences could be detected in places only. This is a noteworthy fact, and the results go to show that differences may be present without being easily seen.

METHOD OF MEASURING, CUTTING, AND WEIGHING PLOTS.

The reader is referred to the plan (Fig. 1) where sighting-poles are indicated by crosses. For measuring purposes the poles were placed on a line which marked the end limits of the plots to be weighed. It will be seen that by standing anywhere on this line (for example, line AB), and sighting in either direction (according to whether the

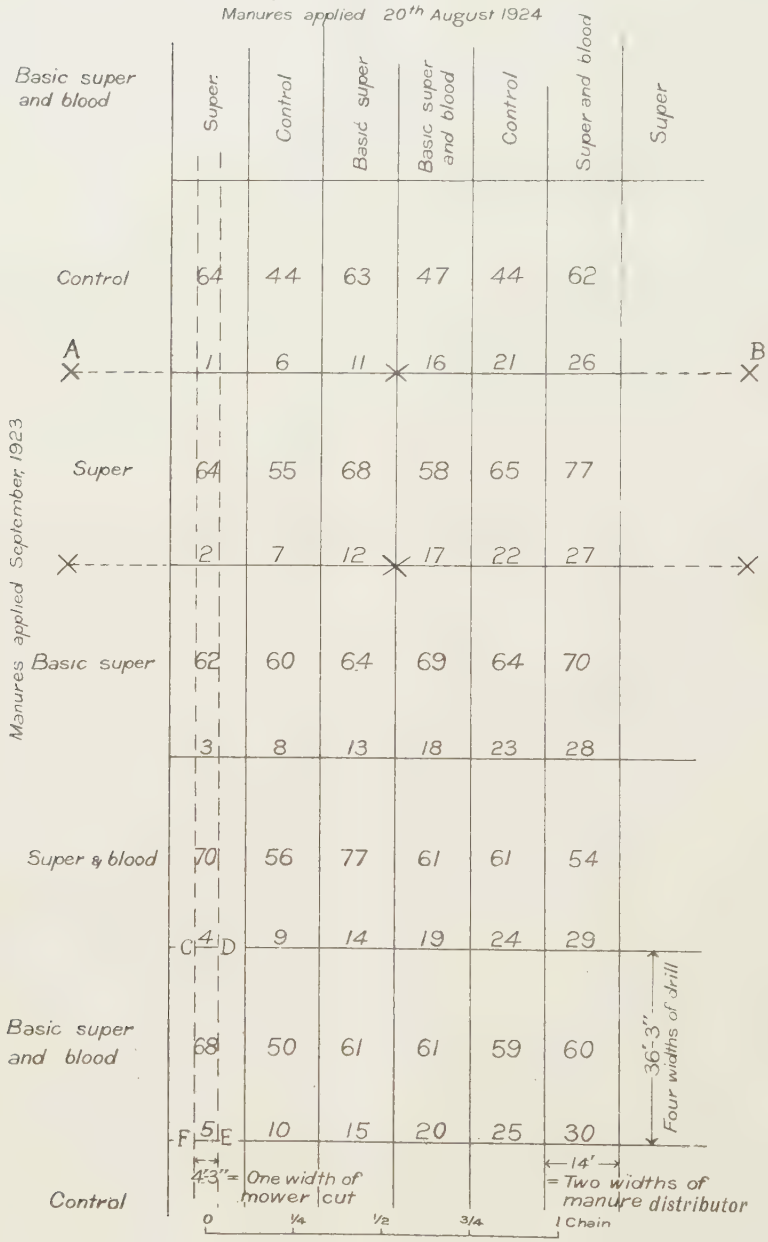


FIG. 1. PLAN OF ONE-SIXTEENTH OF TOTAL AREA OF PASTURE TOP-DRESSING EXPERIMENT ON FARM OF W. G. MACARTNEY, TAI TAPU.

The size of an individual weighed plot is 36 ft. 3 in. by 4 ft. 3 in. = $\frac{1}{283}$ acre, and is indicated by the rectangle CDEF. The total number of areas weighed was 480. The figures 1 to 30 at the bottom of each rectangle are simply plot

observer is one side or the other of the centre pole), it is possible to determine the end limits of the plot without measuring during the weighing. Every plot was marked out as indicated, and the area of each was $\frac{1}{288}$ acre.

By cutting through the crop at right angles to the line AB, and along the junction of the two middle plots, four sides were available on which to work. This arrangement is important, as it enables the farmer who is co-operating in the experiment to carry on his harvesting operations with as little delay as possible. In the experiment under review only two sides were worked, as the weighing staff was small, and the field contained an ample area outside the experimental portion on which cutting could be done while weighings were in operation. A straight cut was made along the edge of the first plot to be weighed, and cutting proceeded in the usual way, except that the mower ran empty along the headlands. As soon as the cut nearest the middle of each of the strips of 1924 dressing was reached, particular care was taken to make the cut a constant width throughout its length. The accuracy with which such a cut could be made was remarkable, the width rarely varying by more than 1 in. either side of the average width of 4 ft. 3 in.

As soon as the cut was started, the weighers followed the machine. The grass on each plot C, D, E, F (see plan) was raked to the middle, rolled into a sheet, and weighed as shown in Fig. 2. No strip was cut until the previously cut one had been weighed. This method ensured the material being weighed under as uniform conditions as were practicable and before drying out took place.

METHOD OF ESTIMATING PROPORTION OF HAY WEIGHT TO GREEN WEIGHT.

Ten samples, each of 10 lb., were weighed to the nearest ounce immediately they were cut. The sampling was done indiscriminately so that a fair average could be obtained. These samples were dried separately under as uniform conditions as possible, and when they were considered to be as dry if not drier than ordinary hay each was again carefully weighed. The average percentage of hay was then calculated, the figure obtained being $36{\cdot}8 \pm 0{\cdot}73$ per cent. The figure following the $\pm$ sign is the "probable error," and may be regarded as a measure of the reliability of the average with which it

numbers which are referred to when discussing the tables of results in the article. The figures in the middle of each rectangle are actual green weights per plot of a typical section of the field, given in order to indicate the variation which occurs among plots of similar treatment; hence the necessity for a large number of weighings.

The plots running across the page are those of the 1923 treatment, and those running from top to bottom are the 1924 treatment, It will be seen that certain plots (for example, where a control of 1924 crosses a control of 1923) have had no manure at all during the two years. These plots are referred to as "double controls," and Nos. 6 and 21 are examples. Other plots which have had treatment with the same manure for the two seasons, as where super 1924 crosses super 1923 (for example, No. 2), or where basic super 1924 crosses basic super 1923 (for example, No. 13), are referred to as "double super" or "double basic super" respectively. In every case comparisons have been made between plots situated alongside one another or separated only by one intervening plot.

The crosses (×) indicate the position of sighting-poles, the use of which obviated the necessity of measuring every plot during weighing.

is associated. By reference to a table of odds we know that it is 13 to 1 (here accepted as practical certainty) against any other similar set of samples varying from the one already obtained, by more than 2·7 times the probable error. It can be said, therefore, that the percentage of hay weight is 36·8 and certainly not less than 34·88—that is, 36·8 — (0·73 × 2·7) of the green weight.

For purposes of evaluating the increases we have taken the percentages of hay as being 34·8, this allowing a margin of safety. The hay weights as calculated are shown in Tables 2 to 5.

Table 2.—Belated Effect of 1923 Dressings on Yields in 1924.

NOTES.—The manurial treatments are compared with double controls (*i.e.*, plots which have received no manure at all during the two years) or with one another. For example, in the case of super, Plot 7 is compared with Plot 6 (see plan), and Plot 22 with Plot 21, Plots 7 and 22 having been dressed with super only in 1923, and Plots 6 and 21 having received no manure at all. The number of plots compared is given in the second column ; for example, the yields and differences between super and control are estimated from thirty-two paired plots, &c.

Hints on reading this and following tables : When a control is shown between two manures both manures are compared with the same controls. When the manures are compared with one another directly it will be noticed that in some cases the yield for a certain manure is slightly different in one place from that shown in another. This is due to the fact that a different number of plots has been used to estimate the average difference in each case. For instance, where super and blood in Table 2 is compared with control, the yield and difference are estimated from twenty-four paired plots. Where, however, super and blood is compared directly with basic super and blood, and with super, thirty-two paired plots are taken. The number of plots compared is governed by the proximity to one another of such plots. Compared plots are bracketed with one another in the tables.

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.*	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	32	2·635	0·550	2 15 1	0 14 6	2 0 7
Control	32	2·085	..	..	..	..
Basic super	32	2·515	0·430	2 13 0	0 13 6	1 19 6
Basic super and blood ..	24	2·396	0·279	1 7 11	0 16 8	0 11 3
Control	24	2·117	..	..	..	..
Super and blood ..	24	2·430	0·313	1 11 4	0 17 5	0 13 11
Super	32	2·635	†	†	†	..
Basic super	32	2·515				
Super and blood ..	32	2·513	†	†	†	..
Basic super and blood ..	32	2·516				
Super	32	2·635	†	†	†	..
Super and blood ..	32	2·513				
Basic super	32	2·515	†	†	†	..
Basic super and blood ..	32	2·516				

* Super (42–44), £7 5s. per ton ; basic super (40–43), £6 15s. per ton ; dried blood (12 per cent. nitrogen), 13s. per hundredweight. † Difference not significant.

This table shows that the manures applied in 1923 gave a sufficient increase in yield in the 1924 hay crop alone to leave a profit. When it is borne in mind that an increased growth must have resulted during the greater part of the time since the application of the manure there need be no doubt regarding the total increase in yield.

FIG. 2. ILLUSTRATING METHOD OF WEIGHING PLOTS.

In this case the crop was light, and a strip was cut down the length of each plot and through the standing crop without undue damage. This method is easier if the crop is not too heavy, the mower being engaged in cutting the remaining portion of the plots when waiting for the weighing operations to catch it up.

Table 3.—Yields from Double Manures compared with Double Controls, and Double Manures compared with one another.

(For explanation of terms "double" manure, &c., see note on plan. Example of comparison: Double super, Plot 2, compared with double control, Plot 6, as shown on plan.)

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.*	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Double super ..	16	2·954	0·873	4 17 3	1 9 0	3 8 3
Double control ..	16	2·081	..	..	..	..
Double basic super ..	16	2·878	0·797	3 19 8	1 7 0	2 12 8
Double basic super and blood	12	2·680	0·535	2 13 6	1 16 8	0 16 10
Double control ..	12	2·145	..	..	..	..
Double super and blood	16	2·803	0·662	3 6 2	1 18 5	1 7 9
Double control ..	16	2·141	..	..	..	..
Double super ..	12	2·965	†	†	†	..
Double super and blood	12	2·863				
Double basic super ..	16	2·877	†	†	†	..
Double basic super and blood	16	2·814				
Double super ..	16	2·954	†	†	†	..
Double basic super ..	16	2·877				

* Total cost of both applications, 1923 and 1924. † Difference not significant.

The increases due to all the manures shown in this table are highly significant and paying ones, but the differences between the yields of the manured plots themselves are not significant. In this case the cost of the manure for the two years has been more than paid for by the increase in only one crop of hay. When it is considered that this crop represents only about one-half of the total growth of grass for the 1924–25 season the results speak for themselves.

Table 4.—Yields from Manures applied in 1924 compared with Double Controls.

NOTE.—In this case, where the dressings applied in 1924 have crossed a control plot of 1923, these are plots with only one dressing of manure. Comparisons are made between these plots and those having no manure (double controls), or between the manures themselves. Examples—(*a.*) Super, 1924 (Plot 1 in plan), is compared with its neighbouring double control (Plot 6 in plan), and so on. (*b.*) Basic super, 1924 (Plot 11 in plan), is compared with basic super and blood (Plot 16 in plan).

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	16	2·934	0·853	4 5 4	0 14 6	3 10 10
Control	16	2·081	..	..	..	..
Basic super	16	2·816	0·735	3 13 6	0 13 6	3 0 0
Basic super and blood ..	16	2·660	0·571	2 17 1	1 0 0	1 17 1
Control	16	2·089	..	..	..	..
Super and blood ..	16	2·869	0·780	3 18 0	1 1 0	2 17 0
Super	16	2·934	*	*	*	..
Basic super	16	2·816				
Basic super	16	2·816	0·156	0 15 7†	..	..
Basic super and blood ..	16	2·660	..	..	..	..
Super and blood ..	16	2·869	0·209	1 0 11	..	..
Basic super and blood ..	16	2·660	..	..	..	..
Super	12	2·863	*	*	*	..
Super and blood ..	12	2·933				

* Difference not significant. † The comparison of basic super and basic super and blood shows a difference in favour of the basic super, which cost 13s. 6d., as against £1 for basic super and blood.

From this table it will be seen that the application of manure was a paying one in every case. The differences between super and basic super and between super and super and blood are not significant, but both basic super and super and blood when compared directly with basic super and blood show a slight increase, indicating that blood in combination with basic super had a depressing effect on growth.

Table 5.—Effect of Application of Manures in 1924 on those of 1923, compared with 1923 Application (1924 Controls) and with one another.

(All plots falling on the controls of the 1923 experiment are eliminated, and in the case of super and control, Plots 2, 3, 4, and 5 are compared with Plots 7, 8, 9, and 10 respectively, &c.)

Treatment.	Number of Plots compared.	Yield of Hay per Acre.	Difference in Hay per Acre.	Value of Difference at £5 per Ton.	Cost of Manure per Acre at Country Station.	Net Profit per Acre.
		Tons.	Tons.	£ s. d.	£ s. d.	£ s. d.
Super	64	2·890	0·404	2 0 5	0 14 6	1 5 11
Control	64	2·486	..	..	..	..
Basic super	64	2·866	0·380	1 18 0	0 13 6	1 4 6
Basic super and blood..	64	2·788	0·185	0 18 6	1 0 0	Loss of 1s. 6d.
Control	64	2·603	..	..	..	..
Super and blood ..	64	2·950	0·347	1 14 8	1 1 0	0 13 8
Basic super	64	2·866	0·078	0 7 10*	..	..
Basic super and blood..	64	2·788	..	..	..	..
Super and blood ..	48	2·997	0·148	0 14 10	..	..
Super	48	2·849	..	..	..	..

* Here, as in Table 3, the addition of blood to basic super has had the effect of reducing the yield of the plots with that mixture to below that of basic super alone.

These results show that the second dressing of 1924 was paid for in the single hay crop, except in the case of basic super and blood. Here again the effect of the blood in combination with basic super seems to be a depressing one. Blood in combination with super gave a slight increase over super alone.

SUMMARY.

W. G. Macartney's Experiment.

(1.) In 1923—a season of extremely light rainfall—manurial dressings of 2 cwt. per acre did not pay in the hay crop taken three months after the application of the manures.

(2.) Eleven months after application a line of demarcation between the treated and untreated areas could be distinctly seen, but this difference was not apparent when the second hay crop was taken.

(3.) Weighings taken fifteen months after treatment showed a significant increase in the case of every manure.

General Conclusions applying to 1924 Experiments.

(1.) In every case, with one exception (basic super and blood, Table 5), the actual cost of manures at country stations had been more than paid for by the increase in one crop of hay.

(2.) If the growth of grass represented by one crop of hay is regarded as half the total growth for the year the net profit resulting from the application of the fertilizers is greatly increased above that shown in the tables.

(3.) The net profit resulting from the application of manures was always slightly in favour of super or basic super.

(4.) In one case only has the addition of blood to phosphate (super) caused an increase in yield—and that a very slight one. In the main its inclusion has not been profitable, and from the experimental data available the use of blood for top-dressing of pastures cannot be recommended.

(5.) In two cases the addition of blood to basic super has resulted in a lower yield than with basic super alone.

(6.) Excepting in the case of basic super and blood, the application of manures in 1924 on the manured plots of 1923 has left a good margin of profit in the single crop of hay. The increases due to the second application, however, have not been so great as those due to the first dressing. With the aid of a damp growing season in 1924 the residual effect of the 1923 manures was very evident.

(7.) As instanced by the grazing during the winter and early spring of 1924, the manures have had a decided effect on the palatability of the pastures.

(8.) The enhanced fertility due to the more vigorous development of clovers which generally accompanies phosphate manuring must be considerable, although its actual value cannot be measured.

(9.) The belated effect of the 1923 dressings indicates that, owing to the possibility of dry-weather conditions, top-dressing should be done in the winter (say, June) rather than in the early spring.

(10.) The amount of £5 per ton, on which the values of increases in hay are estimated, is purely a nominal figure, and should it be considered too great for this season's crop the substitution of a reasonably lower figure will in almost all cases still show a handsome margin of profit.

The writers' thanks are due to Messrs. W. G. Macartney and T. Bloor for facilities afforded in carrying out the experiments, also to Mr. W. Carter, who rendered valuable assistance. Mr. E. J. Fawcett, B.A., Assistant Instructor in Agriculture, Hastings, was very closely associated with the work in 1923. He compiled the results of the first season's work, and his valued assistance is duly acknowledged.

Seed-testing Practice.—At the New Zealand Official Seed-testing Station, in order to conform with American and European practice, the germination percentages of mangolds, beets, &c., will in future be expressed as percentages of the number of balls which show sprouts, irrespective of the number of sprouts per ball. The discarded method gave the total number of sprouts per 100 balls.

Noxious Weeds Act Orders.—The Southland County Council has declared Californian thistle and ragwort *not* to be noxious weeds within that county; the Portobello Road Board has similarly declared Californian thistle within its district. The following are recent declarations of plants as noxious weeds: Kiwitea County, hemlock; Carterton Borough, broom, elderberry, ox-eye daisy, pennyroyal, St. John's wort; Masterton Borough, hemlock and fennel.

GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1924–25.

R. McGILLIVRAY, F.L.S., Fields Division, Invercargill.

FORAGE CROPS. (SECTIONS 5A AND 5B.)

THE crops grown in these sections during the season consisted of Thousand-headed kale, chou moellier, cabbage, oats and peas, and rape. Germination in all cases was good. Cabbage and rape suffered badly from club-root, while Thousand-headed kale and chou moellier, although attacked, withstood the disease in quite a remarkable manner. Thousand-headed kale was not affected to any extent by the long spell of dry weather experienced during the summer.

CROP OF OATS AND PEAS AT GORE EXPERIMENTAL AREA.

OATS AND PEAS FOR HAY. (SECTION 6.)

The sowing consisted of Garton oats, 2 bushels, and partridge peas, 1 bushel, per acre. This resulted in a splendid crop, which was saved in a very bright condition. A considerable number of weighings were taken while the oats were in the ripening stage, in order to ascertain the difference between weights at that time and later when in the dry state. The samples taken were weighed again three weeks later, when it was found that the average dry weights were exactly one-third of the earlier weights.

SCOTCH TARES FOR SEED. (SECTION 7.)

This section was sown in February, 1924, at the rate of 1½ bushels of oats and the same quantity of tares per acre, together with superphosphate at 2 cwt. per acre. This was primarily a seed crop, the oats being combined for the purpose of keeping the tares up off the ground. Oats and tares, autumn sown, is a crop that has much to recommend it as a smotherer where Californian thistle is troublesome. The spring growth in this case was heavy and so dense that no weeds had any chance of showing up. The yield of tares was 658 lb. per acre.

OAT VARIETY TRIAL. (SECTION 8.)

The varieties in this trial were Crown, Golden Rain, Victory, and Great Mogul. They were sown in September, with basic superphosphate at 2 cwt. per acre. All varieties made very satisfactory growth. Golden Rain and Victory matured earlier than other varieties. Small birds did a great deal of damage to all varieties. The yields were as follows: Crown, 34 bushels; Golden Rain, 26 bushels; Victory, 31½ bushels; and Great Mogul, 42½ bushels per acre.

WHEAT VARIETY TRIAL. (SECTION 2.)

The varieties tested were Marquis, Major, and Solid-straw Tuscan. All were sown in August at the rate of 3 bushels per acre, and were manured with basic super. Marquis was the first to show above ground, and made rapid growth thereafter, being cut a fortnight before the other varieties. The yields per acre were as follows: Marquis, 16·25 bushels; Major, 21 bushels; and Solid-straw Tuscan, 33·33 bushels. In the case of Marquis the depredations of small birds were very severe, amounting to about half the crop.

WHITE CLOVERS. (SECTION 9A.)

This experiment was laid down in December, 1923, and consists of equal-sized areas of Dutch white, English wild white, and New Zealand white. The trial is a most interesting one, and the section has had many visitors. The object is to ascertain the difference in habit of growth of the several types. Germination was very good in the case of the New Zealand clover, but rather unsatisfactory in the case of the other two. The Dutch white proved a larger plant than either of the others. The New Zealand white and English wild white were very similar in habit of growth, but the English was on the whole a smaller plant and later in flowering by about three weeks, and never at any time flowered to the same extent as the New Zealand strain. The whole area was limed with 10 cwt. per acre of burnt lime in August last, and top-dressed with basic super in September. Since being laid down the area has been hayed once and grazed when necessary.

MANURIAL TREATMENT FOR POTATOES. (SECTION 3.)

This test was undertaken for the purpose of obtaining data on manurial treatment for potatoes in the eastern districts of Southland. The scheme was as follows, all weights stated being per acre: Plot A,

super, 2 cwt. per acre. Plot B, super, 2 cwt.; kainit, ½ cwt. Plot C, kainit, ½ cwt.; sulphate of ammonia, ½ cwt. Plot D, super, 2 cwt.; kainit, ½ cwt.; sulphate of ammonia, ½ cwt. Plot E, super, 2 cwt.; sulphur, ½ cwt. These groups were repeated twenty times, and Plot A in each case was considered the control. The variety chosen for the experiment was Arran Chief. It was observed at time of planting that the tubers were encrusted with the sclerotia of corticium disease. This disease is quite common in potato crops, and in some quarters not considered of any consequence. Of recent years, however, the disease appears to have become more virulent, and in the case of this experiment it completely nullified the whole undertaking. In the yield from the area of 1½ acres there were not more than about six sacks of table potatoes. It was noticed that about 20 per cent. of the plants came through the ground having a very sickly appearance, and made little growth. The early shoots in many cases were injured, with the result that the plants put forth a second growth. This

EASTERN PART OF GORE EXPERIMENTAL AREA.

growth was lacking in vigour, and made but a feeble stand against the progress of the disease, and by the end of January 85 per cent. of the plants had succumbed. Where the complete fertilizer was used (Plot D) better growth was made for a time, but finally all plots appeared to suffer equally. Special measures will be taken next season to control this disease.

CARROT VARIETY TRIAL. (SECTION 9C.)

The varieties were Sinclair's Champion, Matchless White, and Altringham. The seed was sown on 22nd October at 1½ lb. per acre. Weights were taken in May with the following results: Sinclair's Champion, 14·65 tons; Matchless White, 19·45 tons; and Altringham, 9·50 tons per acre.

TICK BEANS AND WHEAT FOR CHAFF. (SECTION 2B.)

The growth of the beans in this crop was not up to expectations, but the low rainfall during the growing season was to some extent responsible for this. The yield was 2 tons per acre (dry weight). The

chaff was well up to expectations, and proved a most palatable ration for horses.

LUCERNE. (SECTION 1A.)

The lucerne stand was top-dressed with burnt lime in August, and the growth during the season was good. The weight of hay produced was approximately 2½ tons per acre.

TRIAL WITH SWEDES FOR CLUB-ROOT RESISTANCE. (SECTION 9B.)

In this trial several varieties of swedes, claimed to be immune or highly resistant to club-root, were each tested against ordinary commercial swedes of similar type, the commercial lots serving as a control. The so-called immune varieties were as follows: Invine's Purple-top, Danish Family 4, Sutton's Hardy White, Bangholm, and a selected lot the seed of which had been saved on the Gore Area from Bangholm roots that were free from club-root. All plots were sown on 13th November, and germination was good. At thinning-time club-root was prevalent in the case of the commercial swedes. Throughout the whole period of growth the Gore special selection was very healthy, and at time of examination there were less blanks in this variety than in any of the others. The results were as follows:—

Variety.	Number of Roots examined.	Number free from Club-root.	Number diseased.	Percentage of Infection.	Yield per Acre.
					Tons.
(1) Irvine's Purple-top ..	376	181	195	51·86	12·37
Commercial ..	364	116	248	63·13	12·36
(2) Danish Family 4 ..	462	253	209	45·23	9·52
Commercial ..	385	117	268	69·61	8·16
(3) Sutton's Hardy White	404	129	275	68·06	6·12
Commercial ..	375	88	287	76·53	4·89
(4) Bangholm ..	417	66	351	86·57	8·84
Commercial ..	344	38	306	88·95	5·44
(5) Gore Selection of Bangholm	467	256	211	45·18	9·79
Commercial ..	385	22	363	94·28	5·44

"DISEASE-RESISTANT" TURNIP TRIAL. (SECTION 1.)

This test was undertaken for the purpose of ascertaining the degree of resistance of Irvine's Green-top Yellow turnip to club-root. As with the swedes experiment, this turnip was grown in conjunction with a control commercial turnip of similar type, two drills of each variety, the plots being repeated sixteen times. The seed was sown on 13th November, with basic super at 2 cwt. per acre. Germination was only fair in all plots. The plants throughout of Irvine's turnip were much more robust than those of the other. Club-root was very noticeable in the controls at the time of thinning, but was not observed to any extent in Irvine's. In May the bulbs were examined and weighed, with the following result:—

Variety.	Number of Roots examined.	Number free from Club-root.	Number diseased.	Percentage of Infection.	Yield per Acre.
					Tons.
Irvine's Green-top Yellow	610	323	287	47·0	12·8
Commercial	539	196	343	63·6	7·5

Mr. T. Pattinson, now of the Winton Area, was Overseer at the Gore Area while the various operations here recorded were under way, and carried out the work in his usual capable manner.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR 1924–25.

FOLLOWING the practice of the two preceding years, the Dairy Division has compiled for the *Journal* a list of butter and cheese factories throughout the Dominion which have obtained for their export produce average grades respectively of 92 and 91 points or over, covering the official year ended 31st March, 1925. It may be mentioned that as from 1st January last the minimum points for first-grade creamery butter and factory cheese were raised from 88 to 90. First grade therefore now runs from 90 points to 100 points. The list is as follows :—

BUTTER-FACTORIES WITH AN AVERAGE GRADE OF 92 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1925.

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Rangitikei	1360	Rangitikei	94·17
Wairoa	1345	Wairoa	94·11
Waitaki	812	Waitaki	93·94
Wangaehu	1326	Wangaehu	93·93
Raetihi	717	Raetihi	93·69
Maketawa	342	M.D.C.	93·56
Taieri and Peninsula (Dunedin) ..	54	Peninsula	93·54
Kaitaia	1298	Kaitaia	93·49
Manutahi	495	Manutahi	93·48
Rata	93	Rata	93·42
Cheltenham	3	Pakeha	93·40
Rangiwahia	750	Quail	93·35
Mangorei	345	Mangorei	93·33
Levin	910	Lake	93·32
Mells	764	Mells	93·32
Pio Pio	603	Pio Pio	93·27
Tariki	1818	Tariki	93·27
New Zealand (Ngatea) ..	291	Anchor, &c.	93·16
Shannon	1489	Shannon	93·15
Awahuri	664	Red Rose	93·14

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Tikorangi	102	Shield	93·13
Taihape	1188	Tikapu	93·13
Kaitieke	1119	Kaitieke	93·05
Kairanga	1768	Longburn	93·02
Waitanguru	1154	Golden Jem	93·00
Maungatapere	1710	Moana	92·93
Tarurutangi	728	Champion	92·92
West Coast Farmers'	675	Silverpine	92·92
Opotiki	337	Opotiki	92·91
Aria	1734	A.D.C.	92·91
Moa Farmers'	341	Inglewood	92·84
Akaroa	1579	Akaroa	92·83
Heretaunga	1230	Heretaunga	92·82
Featherston	360	Featherston	92·82
Kiwi	299	K.D.C.	92·80
Oruru-Fairburn	1337	Fairy	92·78
Mangatoki	136	Mangatoki	92·77
Murchison	1888	Airship	92·75
Tolaga Bay	1007	Tolaga Bay	92·75
Pihama	627	Pihama	92·69
Ruawai	66	Ruawai	92·69
Midhirst	110	Rugby	92·68
Mauriceville	14	Mauriceville	92·66
Kia Ora	926	Kia Ora	92·66
North Taranaki	723	Flax..	92·65
Hauraki Plains	1900	Hauraki Plains ..	92·64
Manakau	815	Manakau	92·64
Kuku	905	Ohau	92·63
Maungaturoto	1407	Maungaturoto ..	92·61
Tai Tapu	175	Tai Tapu	92·60
Farmers' Dairy Federation ..	336	Murihiku	92·55
Whangarei	1720	Kauri	92·52
Bay of Plenty	1399	Bay of Plenty ..	92·51
Municipal Milk	202	Rahui	92·48
Hawera	346	Federation	92·47
Avon	963	Avon	92·43
East Tamaki..	301	East Tamaki	92·42
Tarata	631	Tarata	92·40
Waitaki (Invercargill).. ..	160	Waitaki	92·38
Eltham	31	Eltham	92·37
Te Aroha	344	Overseas, &c.	92·31
Northern Wairoa	1358	Northern Wairoa ..	92·29
Konini	1203	Konini	92·26
Waitara	726	Waitara	92·24
Canterbury Central	55	Fern Leaf	92·24
Taieri and Peninsula (Oamaru) ..	1234	Peninsula	92·23
Arahura	1516	Arahura	92·20
New Zealand (Otorohanga) ..	185	Anchor, &c.	92·19
Bell Block	488	Bell Block	92·16
Sefton	28	Star	92·16
Rongotea	8	Rongotea	92·14
Co-operative of Otago.. ..	266	Huia	92·12
Golden Bay	146	Sovereign	92·12
Riverdale	106	Trident	92·10
Lepperton	49	Lepperton	92·08
Normanby	24	Steering Wheel ..	92·05
Karamea	1570	Karamea	92·04
Kaipara	794	Poplar, &c.	92·03
Golden Coast	991	Golden Coast ..	92·03
Cheddar Valley	611	Cheddar Valley ..	92·00
Whangaroa	658	Whangaroa	92·00

CHEESE-FACTORIES WITH AN AVERAGE GRADE OF 91 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1925.

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Te Horo	134	Allies	93·30
Maungataua	1708	Maungataua	93·15
Omimi	74	Omimi	93·09
Ballance	1	Ballance	93·00
Opouriao	1169	Opouriao	92·94
Nireaha	335	Nireaha	92·92
Kuku	905	Ohau	92·91
Temuka	207	Ohape	92·91
Ryal Bush	477	Ryal Bush	92·75
Mosgiel	161	Mosgiel	92·70
Kairanga	182	Kairanga	92·69
Waianiwa	1171	Waianiwa	92·67
Stirling	292	Stirling	92·63
Tisbury	701	Tisbury	92·60
Little Akaloa	32	Little Akaloa	92·56
New Zealand (Aka Aka)	121	Anchor, &c.	92·52
Rimu	1155	Rimu	92·49
Paretai	271	Paretai	92·47
Cambridge	128	Cambridge	92·46
Awatuna	60	Awatuna	92·43
Oroua Downs	94	Oroua Downs	92·43
Toa Toa	817	Toa Toa	92·36
Milford	267	Milford	92·36
Waikouaiti	18	Waikouaiti	92·35
Norfolk	1093	Norfolk	92·32
Mangatoki	1086	Mangatoki	92·32
Okato	85	Okato	92·28
Edendale	36	Edendale	92·28
Maharahara	984	Maharahara	92·28
Alton	1890	Alton	92·27
Opouriao	1813	Ruatoki	92·26
Waimana	1817	Waimana	92·25
Pihama	627	Pihama	92·24
Kai Iwi	1565	Kai Iwi	92·23
Barry's Bay	401	Barry's Bay	92·21
Takamatua	33	Takamatua	92·21
Drummond	1823	Drummond	92·20
Pihama	1111	Pihama	92·19
United	1220	Whariti	92·19
Riverbank	985	Riverbank	92·18
Taratahi	101	Taratahi	92·18
Tokoroa	255	Tokoroa	92·18
Whiterig	798	Whiterig	92·16
Tuturau	132	Tuturau	92·13
Horsham Downs	1089	Horsham Downs	92·13
Milton	1030	Milton	92·12
Woodville	1892	Woodville	92·12
Brydone	1821	Brydone	92·10
Orari	254	Orari	92·10
New Zealand (East Tamaki)	149	Anchor	92·08
Pembroke	234	Pembroke	92·05
Wairewa	471	Wairewa	92·05
Patua	73	Patua	92·02
Pine Bush	543	Pine Bush	92·01
Kaitangata	1648	Kaitangata	92·01
Dannevirke	391	Dannevirke	92·01
Glen Oroua	906	Glen Oroua	91·99
Mata	258	Vale	91·99

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Kakaramea	630	Penguin	91·98
Gorge Road	567	Gorge Road	91·97
Seaward Downs	702	Seaward Downs ..	91·96
Clandeboye	1517	Clandeboye	91·96
Mells	1148	Mells	91·96
New Zealand (Hairini) ..	120	Anchor, &c.	91·95
Ashburton	81	Ashburton	91·95
Kaimata	992	The Oaks, &c. ..	91·94
North Taranaki	212	Waipapa	91·93
Marima	195	Marima	91·93
Manakau	815	Black Swan	91·91
Staveley	1719	Staveley	91·91
Brunswick	1290	Brunswick	91·89
Otamita	17	Otamita	91·88
Makowhai	213	Makowhai	91·85
Kaponga	1696	Rowan	91·84
Momona	1010	Allantown	91·84
Bainesse	808	Bainesse	91·84
Kokotau	809	Kokotau	91·84
Hamua	164	Hamua	91·84
Tokomaru	972	Tokomaru	91·84
New Zealand (Rukuhia) ..	114	Anchor, &c.	91·82
Mataura	38	Mataura	91·80
Mangatoki	136	Mangatoki	91·75
Tariki	216	Miro	91·74
Mells	764	Mells	91·73
Kiritaki	1521	Premier	91·73
New Zealand (Eureka) ..	353	Anchor, &c.	91·72
New Zealand (Matatoki) ..	177	Anchor, &c.	91·72
Tuna	209	Tuna	91·71
Otautau	1610	Otautau	91·71
Freshford	1224	Freshford	91·71
Bell Block	71	Dove	91·70
Cam	168	Cam	91·69
Boggy Burn	703	Boggy Burn	91·66
Takapau	75	Takapau	91·68
Northope	383	Northope	91·67
Kohi	923	Kohi	91·67
Mangatoki	1087	Mangatoki	91·67
Awarua	545	Awarua	91·67
Okato	48	Puniho	91·66
Henley	1627	Henley	91·64
Tamaki	1463	Bell	91·63
New Zealand (Okoroire) ..	189	Anchor, &c.	91·61
Eltham	1039	Rotokare	91·60
Silverstream	264	Silverstream	91·60
Thornbury	1581	Thornbury	91·60
Kennington	205	Kennington	91·60
Woodlands	1485	Woodlands	91·60
Mokotua	67	Mokotua	91·59
Aparima	188	Aparima	91·59
Awatuna	1622	Taungatara	91·58
Wairuna	712	Wairuna	91·57
Kaponga	1694	Kaponga	91·57
Wyndham	59	Wyndham	91·54
Pukerau	480	Pukerau	91·53
Tamaki	58	Big Ben	91·53
Ngaire	25	Triumph	91·53
Rahotu	1800	Rahotu, &c.	91·47

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
			Points.
Morton Mains	1604	Morton Mains	91·47
Waitoitoi	20	Waitoitoi	91·45
Tariki	1700	Tariki	91·44
New Zealand (Wharepoa)	173	Anchor, &c.	91·44
Kakepuku	83	Kakepuku	91·44
T. L. Joll	1723	Maori Chief	91·43
Lower Valley	322	Lower Valley	91·42
Mangawhata	1343	Mangawhata	91·42
Kaponga	1695	Riverlea	91·41
Tikorea	833	Tikorea	91·40
Wright's Bush	206	Wright's Bush	91·39
T. L. Joll	1727	Maori Chief	91·38
Hauraki Plains	1900	Hauraki Plains	91·38
Tawaha	1722	Tawaha	91·36
Warea	87	Warea	91·36
Kaupokonui	633	Kaupokonui	91·35
Island	72	Island	91·34
Rongokokako	280	Rongo	91·34
North Tiraumea	1599	Kohinui	91·31
Tiakitahuna	1889	Tahuna	91·30
Okato	57	Leith	91·29
Menzies Ferry	623	Menzies Ferry	91·29
Pihama	1112	Pihama	91·27
New Zealand (Huirau Road)	172	Anchor, &c.	91·27
Manawatu	1189	Reliance	91·27
Fairfax	1004	Fairfax	91·25
Lochiel	659	Lochiel	91·24
Royal Oak	693	Royal Oak	91·23
Mangatoki	256	Mangatoki	91·23
Kaupokonui	1100	Kaupokonui	91·23
Manutahi	495	Manutahi	91·22
Whiteman's Valley	215	Daybreak	91·22
Kaupokonui	1099	Auroa	91·21
Pahiatua	140	Rival	91·18
Collingwood	1742	Collingwood	91·18
Bell Block	488	Bell Block	91·18
Eltham	1047	Cheal	91·16
Bruntwood	1534	Bruntwood	91·16
Goodwood	1559	Goodwood	91·16
Riverdale	106	Trident	91·15
Switzers	802	Switzers	91·14
Mangaroa	252	Onward	91·14
Ashhurst	1886	Hinemoa	91·14
Bidwill	270	Bidwill	91·14
Eltham	1043	Mata	91·12
Pigeon Bay	805	Pigeon Bay	91·11
Eltham	31	Eltham	91·08
Tararua	444	Tararua	91·08
Rongomai	1001	Rongomai	91·06
Otaraia	1721	Otaraia	91·05
Lepperton	49	Lepperton	91·04
Eltham	1036	Rawhiti	91·03
Kaupokonui	1733	Katua	91·03
Kaupokonui	174	Skeet	91·02
New Zealand (Manawaru)	77	Anchor, &c.	91·02

SEASONAL NOTES.

THE FARM.

LOW-LYING PADDOCKS.

THE practice of stocking low-lying paddocks when waterlogged is to be strongly condemned. It must be admitted that many farms have no high land on which to feed stock during the winter, but the area used should be reduced as much as possible, and every available paddock left unstocked while wet and reserved for spring and summer feed. This can only be done by growing sufficient hay, silage, and roots to make the stock more or less independent of what little grass there may be. Wherever possible hay and roots should be carted from the flats to the poorer hills, and the stock maintained there during the winter. The dairy cows as they calve should not be expected to wander round water-logged paddocks looking for a bite of grass. They would be better confined to a small, dry area and more or less stall-fed, and it would certainly be much better for the pasture. The great growth of buttercup, pennyroyal, and docks seen on low-lying pastures after a wet winter is a direct indication of the damage done by winter stocking.

DRAINAGE.

Open ditches should be inspected after flooding, and any obstructions removed from time to time. The mouths of mole or tile drains should also be watched after heavy rains and any blockage investigated. In such cases wet patches above ground in the known course of the drain will be observed, and by digging down the cause will usually be located. Indications of want of drainage in many fields will now be apparent, and plans for future work should be thought out to be materialized later. Surface water should be let off areas under crop after heavy rain, but surface draining is more or less of a makeshift, and every endeavour should be made to under-drain as soon as possible. Money spent on cultivation, lime, or manures is largely wasted where insufficient drainage is the controlling factor.

LIMING.

The coming month is a suitable period for carrying out liming operations. For the heavier types of clay land, drained swamp, &c., the use is advised of from 10 cwt. to 1 ton of ground burnt lime, or on lighter soils crushed limestone (carbonate of lime) from 1 ton upwards per acre. Even if no marked result is observed in plant-growth from the use of lime, there can be no doubt that the resultant feed contains quality which will be reflected in the appearance of the stock. Farmers must be warned, however, against thinking that lime is a cheap substitute for manure. The practice of mixing lime and manure is one which often results in the crop receiving about half the phosphate which it requires. Where heavy liming is practised provision should also be made for keeping the soil provided with organic matter. Liming increases the activity of the bacterial life in the soil,

but unless the organic content is kept up the general fertility tends to suffer.

TILLAGE.

Generally speaking, the average land is more or less saturated at this period, which means that cultivation work should be held in abeyance. Ploughing should always be postponed if the furrow shows a glaze caused by the pressure of the mouldboard. A certain amount of risk may be taken in turning over old lea when somewhat wet, but never in the case of land recently under cultivation. Provided soil conditions are suitable, however, no reasonable opportunity should be lost in turning areas intended for spring crops. Far too many crop failures are due to late preparation and sowing on raw soil not sufficiently weathered.

LUCERNE AND RED-CLOVER STANDS.

Under Canterbury conditions lucerne-fields which have not already been cultivated should be deep-grubbed at once in order to allow winter conditions to improve the soil for next season's growth. The top-dressing of lucerne stands with 2 cwt. super per acre may now also be done.

In Marlborough, when conditions are dry enough, July is the best month for the cultivation of clover and lucerne stands. Land being prepared for lucerne should be well limed at the rate of 1 ton of crushed carbonate of lime, at the latest by the end of July. On the earlier country it should be the aim either to sow the lucerne in August or else to postpone the sowing till October. Lucerne should be given a chance to germinate before the weeds get well away, or failing this the sowing should be delayed so that the land may first be well cultivated and freed from all weeds. Red-clover stands which show signs of running out should be cultivated with the lucerne cultivators, surface-sown in weak places, and brush-harrowed. The whole stand should then be top-dressed with super at the rate of about 2 cwt. per acre.

MISCELLANEOUS.

Potato-pits should be inspected occasionally to see that they are frost-proof and dry. In most cases picking over will commence now, and this should be proceeded with if many rotted potatoes are noticed, otherwise the remainder of the potatoes in the pit may be contaminated.

July is a good month for cleaning yarrow-infested fields. Ploughed and grubbed occasionally, yarrow-roots will carry sheep very effectively in midwinter, and, providing the ground is dry, the winter fallow puts the land in good heart for the following spring-sown crop.

Land in which it is intended to grow commercial crops of garden-peas for seed should now be well cultivated and top-dressed at suitable opportunities. Better results are usually secured in this way than by sowing the manure with the pea-seed.

Club-root in turnips and swedes has taken a heavy toll in many districts this season. There is considerable carelessness in the use of diseased roots, and they are frequently thrown out on the manure heap, to be later carted out on the land, thus spreading the disease.

—*Fields Division.*

THE ORCHARD.

PRUNING.

PRUNING, which was dealt with at some length in last month's notes, should be pushed ahead with all possible speed. This work takes precedence over almost all other operations during the dormant period. Some varieties, such as Rome Beauty, are often left until the trees show signs of coming into flower. This practice is quite a good one if the pruner is unable to determine which are fruit-buds. Rome Beauty invariably bears its fruit on the ends of young laterals, and it is difficult at times to determine whether the terminal buds are flower or leaf buds. Where such is the case no harm will result if pruning is deferred until one can be certain.

Gathering up the prunings is often looked upon as being very tedious and is at times neglected. No progressive grower, however, would leave this work undone, and it should be regarded as important. Moreover, all the prunings should be burnt, otherwise they are only a source of disease infection to the orchard.

SPRAYING.

It will not be necessary to do much spraying at this period of the year. However, where San Jose scale has been in evidence on stone-fruit trees they should receive a dressing of lime-sulphur, 1–12 to 1–15. Care should be always taken to cover every portion of the tree with the spray, otherwise any portion missed may easily become a source of reinfection. Varieties of stone-fruit very susceptible to leaf-curl should be sprayed in July either with bordeaux, 8–6–40, or pure blue-stone, 1–12 to 1–15, followed in August with a further application, details of which will appear in next month's notes.

All spraying-material should now be procured in readiness for the spraying season, which commences in real earnest during August.

PLANTING.

Where extension of orchard areas is contemplated, and the land has been ploughed as previously advised, it should now receive several diskings, &c., when the weather is favourable. Thorough preparation of the soil before planting is a very important factor, and one upon which future success largely depends. If the weather is favourable and the soil in good order, planting may be done, but unless the best possible conditions prevail the work is better deferred. Planting operations carried out when the soil is wet can only have a bad effect upon the trees; moreover, the land is left in a very unsatisfactory state for future working.

If the trees intended for planting have come to hand, a trench should be dug in a nice dry location and the trees heeled in it, covering the roots with earth and tramping firmly. The trees will keep in this position until required. Before planting in permanent position cut off all broken and bruised roots. When digging the hole see that the centre is slightly higher than the sides, in order that when spread out the roots will have a downward tendency. Take care to plant the trees about the same depth as they were in the nursery. When the trees have been placed in position in the holes,

spread the roots out evenly, cover with fine soil, and tread firmly. This is necessary in order that the young rootlets may get a hold of the soil. After the first filling of earth place a handful of superphosphate around the outer edge of the hole, then fill in with soil. Always leave a few inches on the surface untrodden. Trees may be pruned back either before or after planting.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS-CULTURE.

Where new plantations are contemplated the work should now be put under way. The first essential is that the soil be in a fit condition for planting. Citrus, as compared with many other fruit-trees, are shallow-rooting, but this does not mean that soil-cultivation to a shallow depth only is required. On the contrary, deep preparatory cultivation is, on the majority of soils, very necessary to ensure good drainage and sweetness. Once the trees are planted it is impossible to undertake uniform subsoil disturbance; such work is therefore better done prior to planting. The aim should be to obtain a well-drained area, subsoiled, and with the surface soil well broken up but retained above the subsoil. Provision should be made for permanent shelter plantations, adequate protection from cold winds and frosty air-currents being necessary. Planting may be done at any time up to late spring, but the sooner the better, as the trees become better established if put in early.

Seasonal work in existing plantations will comprise the following: Harvesting of fruits ready; trimming of shelter-belts; cleaning out of drains and, where required, the making of furrows to take away surplus rain-water; and, above all, the removal of all twigs and branches which sweep or drag on the soil, as a precaution against the spread of citrus brown-rot.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

BREEDING FROM PULLETS.

It may be as well to reiterate that if pullets are desired for laying early next autumn (when eggs may be expected to command good prices) the chickens should be hatched out during July. It may be said, and rightly so, that on the majority of poultry-farms eggs from the adult stock are not available for hatching purposes at this period, owing to the birds not having resumed laying after the moulting process. The subject is certainly a difficult one, especially in the South Island, where few second-year birds will lay sufficiently early for incubation work to commence in July. In such cases the only safe course is to use pullet-eggs for incubation rather than to delay hatching operations.

In a general way it is not advisable to breed from pullets if hens can be obtained, but, as with all other things pertaining to poultry-keeping, local conditions must always be taken into account. The use of pullets is not so much objected to when they have commenced to lay without being forced early in the year, and have moulted at the usual time

—that is, with the adult birds, about April or May. Further, the birds should be well grown, and at the time of mating should produce a standard-weight egg—2 oz. or over. Moreover, the pullets used for breeding should be only those bred from hens in the preceding year. Breeding from pullets generation after generation is not recommended.

Wherever possible the pullets should be mated with a specially vigorous second-season male. Cockerels and pullets should never be mated together where possible to avoid it. Of course, reference is now made only to early hatching for the production of pullets for autumn and early winter laying, as August and September share favour as being the best months for hatching out the main flock of layers.

BROODING-PROBLEMS.

While the quality and constitution of the breeding-stock determine to a large extent the quality of chicks produced, satisfactory progeny depends on something more than parentage. A high-type layer cannot be bred from inferior stock, but progeny from the best foundation blood ever known will prove disappointing if the chicks are not fed well and carefully handled from the day they leave the shell and right through all stages of their development.

Notwithstanding the great improvement that has taken place in brooder appliances during recent years, and the manner in which the work of rearing incubator chicks has been simplified, so far nothing has been designed to perfectly take the place of the natural mother. This is chiefly because, whatever the weather conditions, the chicks can always enjoy under the hen that absolute uniformity of warmth demanded by them, and at the same time breathe the fresh air so essential to their welfare. Thus in the artificial rearing of chickens the greatest success will never be achieved unless the attendant pays special attention to the control of temperatures and ventilation at all stages of the process. Even with the best makes of brooders there are no hard-and-fast methods that can be laid down to ensure success. Local conditions and extremes of weather—both cold and heat—are apt to upset the best set of instructions ever planned. The only safe course is to go back to the old hen and study her methods of rearing chickens. A fact not to be overlooked is that the hen, in nature's medium, can rear her young without any assistance from a human being. Thus if man is to be independent of nature he must by careful study and observation seek to provide conditions resembling the natural method as closely as possible.

There are probably more chickens that die owing to chills, or fail to reach a proper stage of development through their evil effect, than from all other causes put together. The common causes of chill are irregular temperatures in the brooder-box, overheating, and insufficient ventilation. Removing the chicks too soon from the incubator to the brooder before they are dry, and giving them too much freedom for the first few days, are also frequent causes of chill. The most manifest symptoms of chill are bowel troubles, excessive thirst, droopy wings, a distressed chirp, and no inclination to either leave the brooder or to eat. When these symptoms show themselves heavy mortality rapidly ensues. Indeed, in such cases it is useless trying to effect a cure, as usually the chicks will die in spite of anything that can be done for

them. Prevention is the only way of dealing with this trouble—viz., by having the brooder so constructed and attended to that extremes of heat and cold may be prevented, while at the same time never allowing stuffiness or draughts to exist.

Feeding, Exercise, and Cleanliness.

On no account should the chicks be overfed during the first few days; indeed, they require no food at all for at least twenty-four hours after being hatched. For the first week especially it is always a good plan to underfeed rather than overfeed. The chick is hatched with a good supply of egg-yolk food, which is drawn into its body about the time the egg commences to pip. Plenty of sleep and a comfortable degree of heat, with provision made for fresh air without draught, are the chief requirements of a newly hatched chick.

The hen should be studied in this respect. Where there is no machine to grind grains sufficiently small for young chicks it will usually pay to purchase a reliable brand of chick-raiser. In these there is usually a variety of grains, and rightly so, as no one grain contains all the elements necessary for healthy chick development. Here the mother hen with her brood when on a good range gives a striking lesson. If the crop of a chicken being reared under these conditions is opened up, a great variety of food such as soft seeds, tender sprouts of grass, insects, and worms will be found. This also provides the lesson that it is unnatural for a young chick to eat hard grain such as broken maize, wheat, &c. With such foods it is always a wise course to moisten the grains with hot water or milk, and allow them to swell before being fed to chicks during the early brooder stages. If there is any doubt on this question a hatch should be divided, giving one half the dry food and the other half food that has been moistened before feeding; then watch results.

Quite apart from any ration that may be fed, it is always a good plan to provide the chicks with a liberal supply of wheat-bran. This may be placed in a shallow receptacle and left for the birds to pick at. Charcoal and grit should also be provided in a similar manner, and be in reach of the chicks at all times. A good supply of finely cut green stuff should be fed daily.

For chicks to be healthy they must have ample exercise, such as may be obtained in a state of nature. There is no better way of inducing this than by scattering a little broken wheat or hulled oats in the litter, so that the birds will be induced to scratch and hunt for the grains. Another way of inducing exercise is to tie up some green material sufficiently high that the chickens will have to jump to secure it.

Strict attention to cleanliness is another important matter. Indeed, it is one of the secrets in successful chicken-rearing. Dirty quarters encourage vermin and disease.

FALSE ECONOMY IN THE FOOD BILL.

One of the worst forms of false economy is to save in the quality and quantity of food for a laying flock. Far better is it to feed half a flock thoroughly well than put a whole flock on an inferior diet or on half rations. Feed is certainly high in price, but nothing will be gained

and much will be lost by not giving the laying bird as much good food as it will eat without waste. Many complaints have reached me of pullets going into a moult just when expected to lay heavily. In most cases this has been traced to underfeeding or the supply of a food of inferior quality which the birds do not relish. It is poor economy, even when eggs are cheap, to keep fowls on a mere living diet, but with eggs selling in the region of 4d. each it is obviously a decidedly weak policy. It is only the well-fed pullet that will produce a maximum yield in the dear-egg season.

The only safe way of reducing the food bill is to provide an abundance of green food, which the majority of producers can grow themselves. In this connection the growing of a patch of lucerne (or even one or other of the clovers) is strongly recommended. These highly nitrogenous plants, finely chaffed and fed separately, will prove most effective for egg-production and be decidedly economical. Even during the winter months well-cured finely chaffed lucerne or clover hay, if boiled or steamed overnight, will make a valuable addition to the morning mash, it having the effect of making the mash appetizing and thereby increasing the egg-yield. The chaff may also be fed separately in a boiled form to birds of all ages. Even chickens a few weeks old will relish it. Unfortunately, in too many cases the lucerne chaff—and particularly the meal—sold for poultry-feeding consists largely of fibrous material, which would be dear at practically any price for promoting heavy egg-laying. Wherever possible the poultry-keeper should grow his own lucerne, as he then will not only be assured of spring and summer green food, but will also have confidence in the quality of the chaff for winter use.

Merely as a laxative, and for the maintenance of a healthy condition, probably there is nothing which will pay the poultry-keeper better to grow than a crop of silver-beet. This plant is not only a heavy cropper, but is also relished by birds of all ages.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

MOVING OF BEES.

If it is desired to move colonies to a new location the work should be carried out at the present season while the bees are dormant. Great losses are often caused by beekeepers postponing moving until the spring. It is well to remember that in our climate—from one end of the Dominion to the other—the dormant condition lasts but a very short time, and full advantage should be taken of it, more especially when the bees are transferred only a short distance. In the latter case there will be an inevitable loss of bees unless the weather conditions are absolutely wintry. The risk in moving bees longer distances is, of course, not as great, because when they are moved from their old landmarks they will not desert their hives until they have taken an inventory of their new surroundings. However, in long-distance removal there is another danger to be feared—namely, that by overheating the colonies a condition known as "scalded brood" may be produced, and result in the destruction of

thousands of embryo bees. The wise apiarist will therefore invariably choose the depth of winter for moving his bees either long or short distances.

PERMANENT SHELTER.

This is the season when it is most evident to the observant apiarist that bees require plenty of shelter from high winds. Where necessary, the planting of shelter-hedges to protect the apiary should now be taken in hand. Experience proves that bees in sheltered positions thrive far better than those in exposed situations. If the hives are protected, the bees can take exercise every sunny day during the winter months, and this exercise is essential to their well-being, as it is only in flight that bees can properly rid themselves of their excreta. Where sufficient shelter is not provided numbers of bees are lost through being beaten down by cold winds and rendered unable to return to their hives. Apart from the benefit to the bees, the apiarist will find his work much more congenial when he himself is protected by permanent shelter. Shelter-hedges should be grown to a height of about 8 ft. and no higher, and this will afford ample shelter for a large apiary. Of the many quick-growing hedges giant privet and tagasaste ("tree-lucerne") are perhaps the best. These plants have been tested throughout the Dominion with good results. In the South yellow-barberry holds pride of place as a hedge for apiaries, because, in addition to affording ample shelter, it yields an abundance of pollen and nectar in the early spring. Whatever species are used, planting should be done with the idea of forming a thick hedge, and not to form a plantation. If tagasaste or giant privet are planted they should be well protected from stock.

LIQUEFYING GRANULATED HONEY.

That honeys granulate and become solid in a certain time is well known to most beekeepers. This phenomenon has given rise to much speculation among consumers as to purity, and consequently producers of pat honey have had to educate the public, who formerly were suspicious that granulated honey was mixed with sugar. The crystallization of honey may be taken as a test for purity. Practically all the honey produced in New Zealand granulates, and the beekeeper may find it necessary to liquefy his honey when bottling. Many beekeepers are unable to procure small vessels in the extracting season, or their time is so much taken up attending to the bees that the honey is run off into larger vessels for the time being. Where the work of putting up the honey in retail packages has been postponed it may now be done.

Liquefying is an important part of the producer's work, and must be carried out with great care, as neglect in this direction will lead to a poor article being put on the market and an injury to his trade. It must be understood that honeys brought to high temperatures become darker in colour and lose their flavour; besides, the higher alcohols which give honey its aroma are driven off. When honey is heated to 170° or 180° F. and over, decomposition of certain sugars sets in, and as a result an inferior article results. Such honey is often seen for sale on the local markets, and tends to deter the average person from eating any honey whatever.

On no account should honey be liquefied by the direct application of heat, and it is extremely important that the temperature should not exceed 140° F. If it is necessary to liquefy bulk honey, this may be done by immersing the vessel in water which is brought gradually to 150°. At this temperature the honey will melt. Clover honey readily liquefies at about 140°. The process of liquefaction cannot be hurried, and if the mass of honey does not melt quickly, then it must be allowed to remain in the water from three to four hours. On no account should greater heat be applied. Too much stress cannot be placed on this point, as on it depends future sales and repeat orders. An ordinary washing-boiler is an excellent vessel to use where granulated honey is to be melted, but one must be sure that the tins are firmly soldered before immersing them. In order that the containers may not come in contact with the boiler it is advisable to place one or two small boards on the bottom of the copper. The tin to be heated is placed on the boards, and care must be exercised in filling the boiler with water. When this has been done, heat may be gently applied until the mass is dissolved. Liquefying honey is at the best a tedious process, but if good results are to be obtained the necessary amount of time must be spent on the operation.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

On the warmer lands growth will recommence towards the end of the coming month. The first opportunity should be taken to hoe the growing crops of early cabbage, cauliflower, broccoli, peas, and lettuce, helping them along where necessary with a little chemical fertilizer. On land well manured and prepared plant out main-crop cabbage, cauliflower, lettuce, and onion plants, these being from seed-beds laid down in late autumn. Plant also sets of shallots and garlic, artichokes, and early potatoes. From 3 cwt. to 4 cwt. of superphosphate and half that quantity of sulphate of potash per acre applied at this period will usually be found a good dressing. This work should be undertaken as soon as the land is sufficiently dry, friable, and warm, and growth commences in ordinary hardy vegetation. Sow early peas and lettuce, and, on firm, clean ground, the main crop of onions where the system of spring sowing is adopted. Rhubarb and asparagus beds will soon commence to make new growth for harvesting: they should be assisted now by a liberal dressing of manures.

BUSH-FRUITS.

Many growers gather heavy crops of berries from currant, gooseberry, and raspberry gardens from year to year without manuring the plants, and wonder why they go back in condition. The remedy is generous manuring for heavy-cropping bushes, and this should be applied now. In the absence of well-prepared organic manures apply bonemeal and superphosphate, with the addition of sulphate of potash, as required. As the plants commence to make new growth apply a good spray of winter-strength bordeaux, to which —for the destruction of

raspberry-bud moth and other early prowling larvæ — arsenate of lead should be added at the rate of 1½ lb. to 50 gallons of spray.

TOBACCO.

Some tobacco-growers who are holding a little dried leaf wish to know how to ferment it in a way suitable for smoking. That operation is nowadays usually carried out by the manufacturer, who has apartments where light, heat, and humidity are under control, and where the process is carried out by men of long experience. Small quantities of dried leaf can be fermented in the following manner during the warmer spring weather—say, about the month of September in average districts: The leaf must first be conditioned by admitting or creating a humid atmosphere, when it becomes tough and pliable, although the midrib is still so dry as to crack when doubled over. It may then be stacked in a storeroom on a low platform, with the butts of the hands outwards and the tips overlapping. The stack should be at least 4 ft. or 5 ft. high and any convenient width. When completed, place a few boards on top and cover with a good tarpaulin. The temperature will soon begin to rise, and careful watch must be kept to see that it does not rise much above 100° F. Should it do so the bulk must be broken down, shaken out, and rebuilt. After about three or four weeks of this treatment the tobacco should be ready for storage, and will improve with age up to within certain limits.

Small quantities of dried leaf may be fermented by carefully packing them in a box that is not too airtight. Place the conditioned leaf so that the butts of the hands are towards the outside. Fill the box so that when the lid is screwed on the contents are under moderate pressure. Watch the product for heating, and open up the package, air, and repack it when necessary.

PLANTING OF TREES AND SHRUBS.

We are now in the middle of the short annual planting season for trees and shrubs. Where such work has to be done there should be no delay in obtaining the plants and heeling them in; also in the preparation of the land in which they are to be planted. It is important that the land shall be worked only when dry and friable; also that the plants, when put into their permanent position, shall be inserted to the same depth at which they have previously grown, and planted very firmly.

LAWNS AND GREENS.

Those who have the care of lawns and playing-greens have now an opportunity to repair the wear-and-tear of the past season—that is, unless it was made good during the late autumn. The treatment will probably take the form of some weeding, feeding, top-dressing, and sowing seeds where the turf is inclined to be thin. Great care is needed to see that the loam used for top-dressing and mixing with the fertilizers is sound and free from weed-seeds. The choice of grass-seeds, too, demands careful attention. It is important that they should not only be fine grasses of a permanent character, but also adapted to the soil and locality; and especially must they be free from seeds of weeds and unsuitable unspecified grasses.

—W. C. Hyde, Horticulturist.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

CONTAGIOUS STOMATITIS IN HOGGETS.

"FARMER," Takaka :—

I am having trouble with a skin-disease among my half-bred hoggets this year. The disease takes the form of small festers or scabs, and is found only around the mouth. Practically the whole mob is affected, some very slightly and others very badly. The flock runs on good, clean, sweet country. Please inform me of the nature of this trouble, and the most effective cure.

The Live-stock Division :—

The disease you describe appears to be contagious stomatitis. This is due to a germ which gains entrance through abrasions on the face and lips of the sheep from thistles or other coarse or prickly herbage. You are advised to put the non-affected sheep on a clean pasture, isolate those affected, and after thoroughly cleansing the affected parts with any mild antiseptic solution apply an ointment consisting of precipitated sulphur, 1 part, and vaseline, 8 parts. This should be used liberally, repeating the treatment after a few days where required.

COWS NOT COMING TO THE BULL.

C. WAY, Ruakaka :—

We have several cows which have not come on to the bull this year—one heifer in particular which has been in for eighteen months and is not now in calf. Could you let me know if the animals can be treated, and, if so, in what way I should go about it?

The Live-stock Division :—

In cases in which several cows fail to show signs of œstrum, or, in other words, do not come on "bulling," the most common cause is malnutrition, and the remedy will be to provide extra nourishment by means of some concentrated food fed daily. Chaff, crushed oats, and bran are most useful for this purpose, and one or two pounds of linseed cake daily will also have a beneficial effect. In the case of the heifer referred to, the cause may lie in some affection of the ovaries. We have also met with cases of this nature in heifers, due to the presence of a mummified fœtus in the uterus. In such cases, of course, only an actual examination of the animal can determine the exact cause.

INTERPOLLINATING DELICIOUS APPLE-TREES.

H. M. SIMMONDS, Tauranga :—

We have an orchard of ten-year-old apple-trees. Gravensteins and Jonathans are doing well, but Delicious, excepting a few growing next to the Jonathans, are producing only about half a dozen apples per tree. All the trees are healthy and making good growth. Do you think these Delicious require another variety to fertilize them?

The Horticulture Division :—

The Delicious apple-tree certainly sets a better crop when satisfactorily interpollinated. Where this variety is largely planted growers sometimes inter-plant Dougherty trees or graft pieces of Sturmer wood into the Delicious trees. Another method is to set blossom of another variety of apple in tins of water among the trees when in bloom. If the Jonathan apple is doing the work satisfactorily, and suits your market, it may pay you to extend your planting of it for the purpose of interpollination.

SWELLING ON YOUNG BOAR'S SHEATH.

J. O. K., Matamata :—

I have a young boar with a swelling in shape like an egg at the point of his sheath. Please advise as to what it is, and if it will affect him in his work.

The Live-stock Division :—

The swelling on the boar might be a tumour; and, if so, will in all probability later on affect him in service. The only treatment in this case is removal of the growth by the knife. A swelling is sometimes seen on the sheath of young pigs, due to an injury brought about by the animals rupturing the tissue of this part in endeavouring to feed out of a too high trough. In this case the swelling is usually soft—containing extravasted blood—and is not of a serious nature, an incision with a knife and antiseptic washing being all that is required.

TOP-DRESSING BUSH SHEEP-COUNTRY.

"BACKBLOCKS," Otorohanga :—

We propose to top-dress some sheep bush-country that has been down for twenty-three years and is mostly in danthonia. It was originally tawhero country, with odd rimu and totara among it. What is the best manure to use, and in what quantities? We would sooner use a manure with a lasting effect, if possible. Would basic slag be of any use on this light country?

The Fields Division :—

High-grade superphosphates would probably be the best proposition on country such as you describe. It is the concentrated form of phosphate, and is therefore cheapest to cart and handle, and is comparatively easy to sow. There is no reason to suppose that it will be exhausted any quicker than slag, and its effect in the first season would almost certainly be greater.

PIZZLE-ROT IN WETHERS.

C. SCOTT-MAUNDRELL, Rata :—

Would you please give me some information about pizzle-rot in wethers? I have had trouble with it in long-woolled sheep. Despite the fact that I keep the wool cut I still notice scabs on the part. Is the trouble contagious, and what is the best treatment?

The Live-stock Division :—

This condition of the pizzle is not contagious. It is frequently met with in wethers, particularly those in good order, and occurs more frequently in the autumn and winter, when the feed has lost its succulency and there is an increased amount of urinary solids. In long-woolled sheep it is necessary that the wool be clipped, and where the condition is present the parts washed, the scab removed, and a little sweet oil applied. An ample supply of fresh drinking-water should be available to the sheep.

POISONING WILD PIGS WITH STRYCHNINE.

"INQUIRER," Otautau :—

I shall be obliged for advice as to whether it is possible to poison wild pigs with strychnine, or whether the fern-roots on which they feed act as an antidote.

The Live-stock Division :—

The usual method for poisoning wild pigs with strychnine is to slaughter an old cow or horse on the ground where the pigs are roaming. Skin and open up the carcase and slash the muscles in different parts, then sprinkle the whole with the strychnine. Usually nothing is left by the pigs but the bones, so there is little risk of dogs being poisoned. Fern-root does not act as an antidote.

WEATHER RECORDS: MAY, 1925.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather during the month of May was remarkable for the number of cyclonic disturbances which passed to the northward of New Zealand, and also for the absence of westerly low-pressure areas. Rainfall was greatly in excess, particularly in the North Island and in the north-east districts of the South Island, but was deficient in Christchurch City and in the west-coast and southern districts of the South Island.

The month opened with stormy weather. On the 6th a disturbance, centered about the Chatham Islands, intensified and caused severe southerly gales along the east coast, the barometer reading 29·46 in. at Chatham Islands, while it was ¾ in. higher in most parts of the Dominion. Anticyclonic conditions followed, but on the 10th a cyclone made its appearance to the northward of New Zealand, causing heavy rain in the North. Further heavy rain was reported about the 14th and 15th, especially in the King-country and northern districts, and a severe thunderstorm was experienced in Auckland at the same time. On the 22nd and 23rd a remarkably steep depression passed over the Dominion and caused widespread storm conditions, especially in the North. Floods occurred in Taranaki, the King-country, and other parts; the Auckland Province also experienced gales and heavy rain. Anticyclonic conditions with fair weather prevailed from the 24th to the 28th, but another cyclone then made its appearance in the North, and the month closed with weather which will be remembered for a long time by the northern inhabitants.

—*D. C. Bates, Director.*

RAINFALL FOR MAY, 1925, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
North Island.	Inches.		Inches.	Inches.
Kaitaia	9·79	18	3·28	5·06
Russell	10·07	15	4·10	3·53
Whangarei	13·61	20	4·18	6·59
Auckland	5·25	24	1·45	4·41
Hamilton	6·07	18	1·50	4·41
Kawhia	13·52	20	3·60	4·77
New Plymouth	7·14	17	1·84	6·16
Riverside, Inglewood	10·31	15	3·64	9·82
Whangamomona	11·37	12	2·80	6·59
Tairua, Thames	9·26	13	2·20	6·11
Tauranga	8·46	15	4·56	4·88
Maraehako Station, Opotiki ..	6·16	13	1·74	4·82
Gisborne	4·97	17	1·57	5·50
Taupo	8·79	12	2·36	3·60
Napier	3·59	15	0·84	4·14
Maraekakaho Station, Hastings ..	4·34	16	1·41	3·52
Taihape	5·76	18	2·00	3·75
Masterton	5·42	23	1·11	3·91
Patea	5·75	16	1·44	3·91
Wanganui	3·54	11	1·14	3·40
Foxton	6·68	12	1·42	2·32
Wellington	6·30	17	0·96	4·74
South Island.				
Westport	3·80	18	0.90	6·58
Greymouth	3·12	14	0·73	8·39
Hokitika	4·94	14	0·81	9·79
Arthur's Pass	12·86	11	5·00	10·93

RAINFALL FOR MAY, 1925—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Okuru, Westland	7·28	8	2·02	11·60
Collingwood	4·56	15	0·84	10·18
Nelson	3·70	10	1·04	3·13
Spring Creek, Blenheim ..	4·91	10	1·50	2·49
Tophouse	4·41	10	1·23	5·46
Hanmer Springs	7·71	14	3·25	3·52
Highfield, Waiau	6·26	10	2·20	2·76
Gore Bay	5·52	11	2·46	3·43
Christchurch	2·12	14	0·75	2·56
Timaru	2·01	10	1·05	1·27
Lambrook Station, Fairlie ..	2·64	6	0·98	1·28
Benmore Station, Omarama ..	2·24	11	0·54	1·75
Oamaru	2·64	10	1·28	1·58
Queenstown	0·84	6	0·32	2·71
Clyde	0·54	2	0·30	0·97
Dunedin	2·79	9	1·40	3·20
Gore	1·20	10	0·35	2·84
Invercargill	2·48	15	0·74	4·55

PRICE OF STRYCHNINE AND CARBON BISULPHIDE.

THE Department has again been able to reduce its selling-prices of these materials for rabbit-destruction. Strychnine will now be supplied at 3s. 6d. per ounce; and carbon bisulphide at 40s. per drum of approximately 50 lb., freight paid to nearest railway-station.

FORTHCOMING WINTER SHOWS.

Wanganui A. and P. Association: Wanganui, 24th to 27th June.
Poverty Bay A. and P. Association: Gisborne, 25th to 27th June.
South Taranaki Winter Show Company: Hawera, 30th June to 4th July.
Wellington Winter Show Association: Wellington, 30th July to 15th August.
Auckland Winter Exhibition: Auckland, 15th to 22nd August.

Chair of Agriculture at Auckland.—The Auckland University College has filled its newly constituted Chair of Agriculture by the appointment of Mr. William Riddet, B.Sc., at present lecturer in dairying and assistant dairy research officer at the Dairy School of Scotland, Kilmarnock. Professor Riddet gained most of his practical experience on his father's farm in Ayrshire. He is twenty-nine years of age.

London Market for Peas and Beans.—The following advice was cabled by the High Commissioner on 6th June: *Peas.*—Maple partridge meet small spot inquiry; New Zealand, 62s. to 72s. per 504 lb.; Tasmanian, 72s. to 82s.; value June shipment No. 1 new crops New Zealand, 65s. c.i.f. Blue in better demand; business principally confined to Japanese and small hand-picked Dutch; no business reported in New Zealand and Tasmanian. *Beans.*—Market quiet but firm; English choice spring selling up to 56s., winter 49s., per 532 lb.; Chinese horse, July-September shipments, offered at £10 7s. 6d. per ton landed and £11 5s. ex store.

PRECAUTIONS AGAINST SPREAD OF FIREBLIGHT.

THE regulations under the Orchard and Garden Diseases Act, prohibiting the removal of certain plants and of bees from portions of the Taranaki and Wellington Land Districts, which were gazetted on 30th March, 1922, have been revoked, and the following regulations made in lieu thereof—coming into force on the 28th May, 1925, the date of their gazetting :—

1. In these regulations "prescribed area" means all that area comprising the counties of Patea, Waitotara, and Wanganui.

2. No plant or portion of a plant of any variety of apple, pear, quince, or *Cratægus* shall be sent or brought from the prescribed area into any portion of New Zealand other than that area comprising the Auckland and North Auckland Land Districts: Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture, under proper safeguards, of plants or portions of plants of any of the above-mentioned kinds from the prescribed area for the purpose of the identification of the disease.

3. (1.) Every package of trees or shrubs, or portions of trees or shrubs, sent from the prescribed area to any portion of New Zealand, other than that area comprising the Auckland and North Auckland Land Districts, must be accompanied by a certificate, in the form set out in the Schedule hereto, signed by the consignor, that no plant or portion of a plant of any variety of apple, pear, quince, or *Cratægus* is contained in the package. (2.) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

4. (1.) No bees shall be sent or brought from the prescribed area to any other portion of New Zealand unless such bees have been effectively quarantined for the six days immediately prior to their despatch from that area so as to prevent their having access to any flowers or other vegetation. (2.) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine, and shall prescribe such conditions for their use as he deems necessary. (3.) Before sending or taking any bees out of the prescribed area the owner shall have them quarantined at one of the appointed places of quarantine. (4.) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the quarantine place to their final destination, an official permit signed by an officer of the Department of Agriculture being attached by tag or label to each parcel of such bees. (5.) No bees shall be accepted for posting or for consignment by rail to an address outside the prescribed area without such official permit being attached to the parcel. (6.) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the prescribed area shall be borne by the original sender of such bees, and shall be payable on demand.

5. Every person who does or omits any act in contravention of these regulations commits an offence, and is liable on conviction to a fine not exceeding £2.

SCHEDULE.

CERTIFICATE TO ACCOMPANY PACKAGES OF PLANTS.

I, THE UNDERSIGNED, hereby certify that no plant or portion of plant of any variety of apple, pear, quince, or *Cratægus* is contained in this package.

Date : Signature :
Place : Witness to signature :

Seed-germination Tests.—Facilities for the making of earth tests will shortly be available at the Official Seed-testing Station. These will be charged for (to seed-merchants) at the same rate as germinator tests, except in the case of turnips, swedes, &c., submitted for purity, when an earth test for the detection of wild turnip, or admixture of swede in turnip, and *vice versa*, will be included as part of the purity analysis.

Meat for Nauru Island.—A contract has been secured by one of the Auckland freezing companies for the supply of 4,900 cases of canned meats to the Nauru Island Administration, for the labourers on the phosphate workings. This business, which represents over a year's supply, was secured in competition with Australian firms.